EDITORIAL

RADIO amateurs have a particular interest in the outcome of the I.T.U. Conference to be held next year in Geneva.

At that conference the allocation of frequency bands will be decided for a further period of time.

Unfortunately for the amateurs, competition for the use of available frequencies becomes greater each year. As on previous occasions, there is bound to be great pressure from some quarters to reduce or remove amateur bands, and unless appropriate action is taken, this is exactly what might happen.

The amateurs will be represented at the conference by their accredited delegates, one of whom will be sent on behalf of the Wireless Institute of Australia, and perhaps the other amateurs in this zone if no other bodies within it are able to take similar action.

But, in the last analysis, it is the individuals themselves who will determine whether their case for survival is a good one.

No amount of official work can convince hard-headed commercial interests that amateurs justify themselves if the figures show otherwise.

Fortunately, in this part of the world, the record makes pretty good reading. We have an excellent total of public service to add up, we have a vigorous and nation-wide organisation in action, and we have some good experimental results to show, particularly in the VHF region.

But what we need, above all else, is full occupancy of the bands, and clean, enterprising use of them.

We just can't have too much of it to convince our own authorities that they should support us when the time comes to do so.

It is essential for our own representative to have this kind of assurance under his belt when he goes to Geneva, and only the complete team of amateurs, Institute members and others, can help him in this.

There is little doubt that everyone is aware of the situation, and its difficulties.

All that remains is for our good words to be put into practice.

Let us have some even better statistics from now on. Remember this each time you go on the air, and resolve to do so at least once a week.

Because, if you don't, you may face the position of having no bands to work. If I may suggest a slogan—"Use them or lose them."

John Moyle

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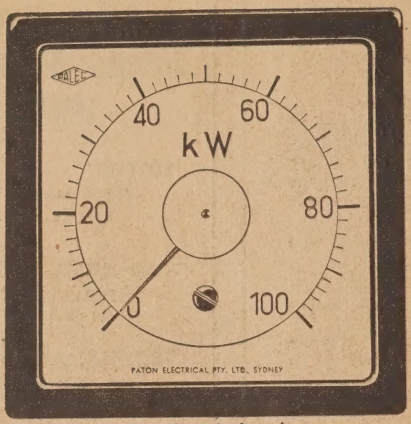

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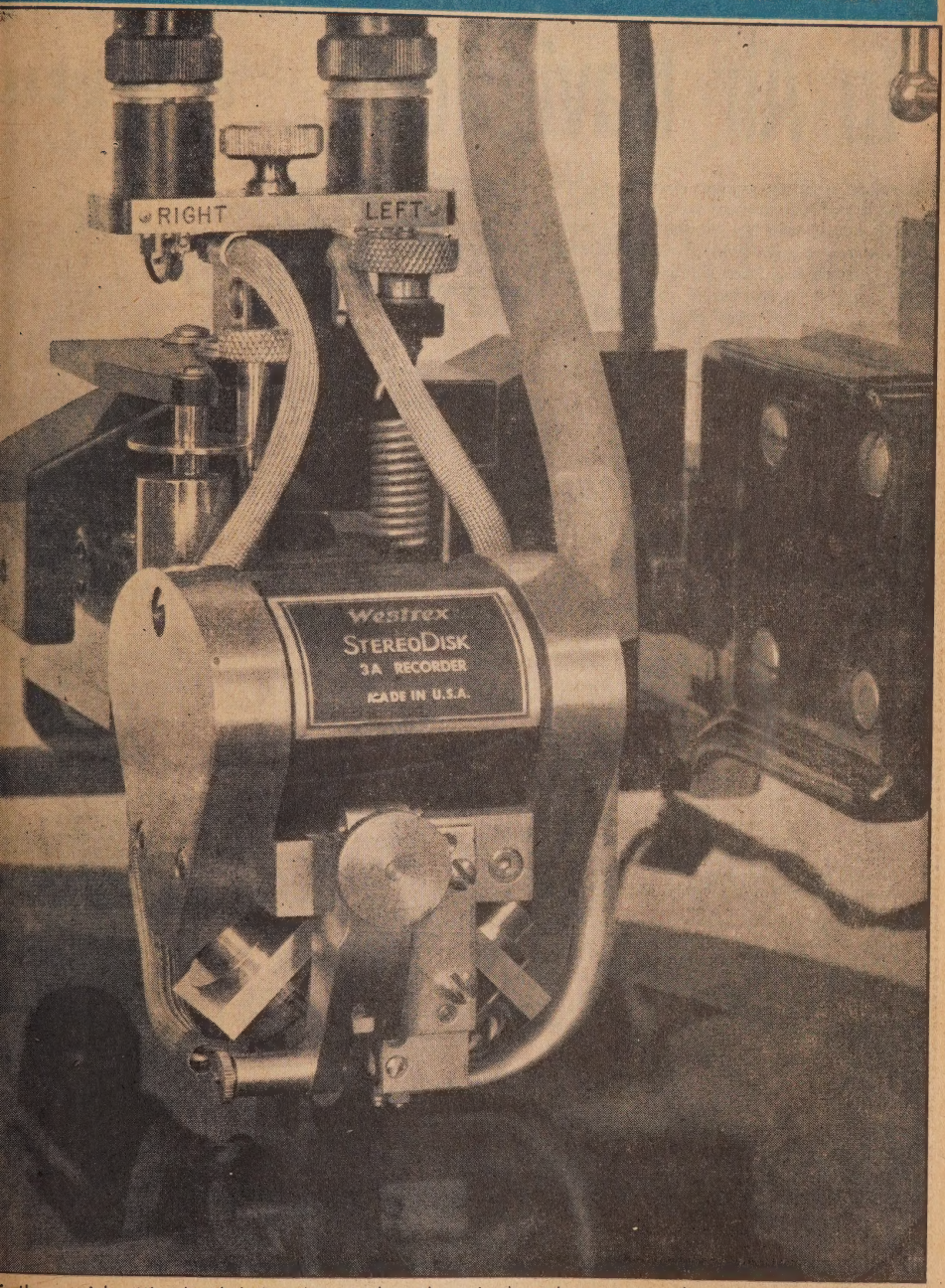
STEREO DISC CUTTER IN ACTION



is the special cutting head designed to produce the twin-channel stereo records which are about to be ed. A single stylus is driven by two energising units instead of one, angle of cut being 45 degrees to cord surface. This picture shows the energising units magnet assembly, exhaust tube, etc. (Story page 9.)

Doppler—A New Era In Air Navigation

By W. J. BAK

More than a century ago an Austrian scientist drew attention to a phenomenon of sound waves which was named after him—the Doppler effect. Since then it has proved an invaluable ingredient in many measuring methods ranging over a vast field of instrumentation in many scientific fields. The same principle has been applied to navigational aids, some of which have been in use for a number of years. Today several systems of this type are being readied for installation in civil aircraft.

IN recent months one of the talking points in aviation circles has been the imminent introduction of an entirely new type of navigational aid for use in civil aicraft — the Doppler Navigator. For over three years the R.A.F. has flown with Doppler equipment aboard. Now the turn of the civil airlines is coming.

The layman who takes his air travel for granted, and anyway has never known his aircraft to lose its way, may well wonder what all the excitement is about. Surely, (he is entitled to argue) in view of the galaxy of dials and instruments already existing in the cockpit, all navigational requirements are fully met.

DIRECTION FINDING

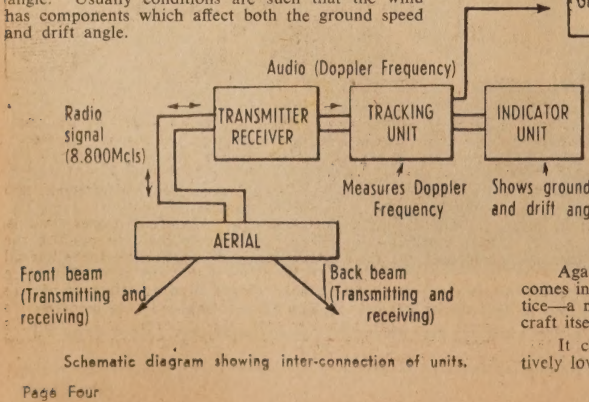
And in any case, exactly what is Doppler equipment and what advantages, if any, has it over existing navigational aids?

To answer these questions we must first review the elementary requirements for finding one's way along a direct route from point A to point B in the course of a cross-country walk. Given a map, a compass bearing, and an accurate positional fix, an accurate positional fix can be obtained with ease at any point along the route.

Air navigation, however, is much more complex than this. The fly in the ointment is the presence of wind velocities which are acting on the aircraft all the time. In other words, the aeroplane is moving through a medium which is itself in motion, and an extremely inconstant motion at that, liable to frequent variation in magnitude and direction.

Thus when an aircraft is heading directly into the wind, its real rate of progress or ground speed will be represented by the aircraft's air speed minus the wind speed. Conversely in a tail wind the ground speed would be the air speed plus the wind speed.

But a much greater complication occurs under sidewind conditions which cause the aircraft to travel over the ground crabwise, with its compass giving the bearing of its fore-and-aft line (heading) while the direction of its aft line (its track) differs from this by an angle referred to as the "drift" angle. Usually conditions are such that the wind has components which affect both the ground speed and drift angle.



Schematic diagram showing inter-connection of units.

In these conditions, assuming our aircraft to be flyi a wind of unknown velocity, we have a state of affa which it is deviating from the desired track by an unk amount and travelling over the ground at an unknown Furthermore, with every change in wind velocity these unknowns are going to alter.

It would seem on the face of it, therefore, that th essentials to successful air navigation must be (a) accurat continuous information as to the drift angle so that the may head his aircraft in such a direction that it will ma the desired track, plus (b) accurate and continuous inf tion about ground speed so that he can tell how far h progressed. In view of this assumption it is perhaps alarming to find that no civil aircraft flying today has eit these provided directly.

There is, however, no real cause for apprehensio cause in point of fact an aircraft can steer to its desti by using other means. In the past, because the provisi continuous drift angle and groundspeed information was to be an insurmountable barrier, the problem was ta obliquely by providing ground stations to transmit inform or more ground stations.

USE OF GROUND STATIONS

There are several such systems in use today, the favoured of which use variants of the principle whereb paratus aboard the aircraft measures the difference (eit time or in phase) between correlated signals arriving fro or mor ground stations.

The information so obtained is either transferred ma on to special charts or recorded automatically as a track stylus upon a roller chart. Thus "fixes" can be obtaine the groundspeed and wind velocity are derived from these required headings to destination can then be calculated.

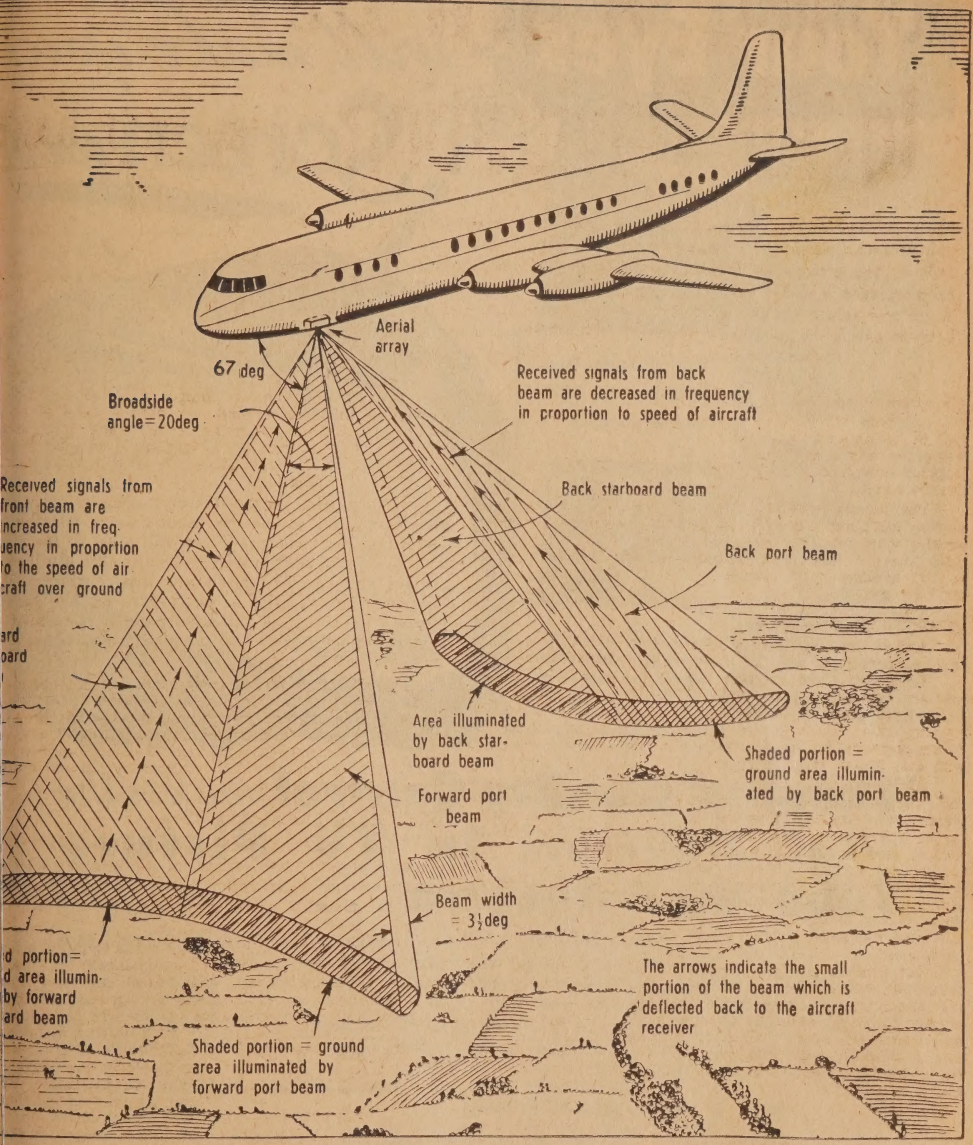
Such systems, by laying radio tracks or grid refer undoubtedly provide a re means of navigation. But are not without disadvan The capital cost of the g stations is high; further they provide navigational lities only along s routes, and the provision of e ground stations to establish coverage would entail protracted national discussions.

The choice of one system for ad as a world standard has long be subject of international controvers the argument currently continues.

Against this background the new Doppler equi comes into focus. It is a radical departure from previous tice—a navigational aid which is entirely contained in t craft itself, needing no ground stations for its functionin

It can be used on a global basis and the cost i tively low; morevoer, it is equally suitable for low-ceilin

IAGRAM SHOWING DOPPLER NAVIGATION PRINCIPLES


Aerial array
67 deg
Broadside angle=20deg
Received signals from back beam are decreased in frequency in proportion to speed of aircraft
Back starboard beam
Back port beam
Received signals from front beam are increased in freq uency in proportion to the speed of air craft over ground
ard oard
Area illuminated by back star-board beam
Shaded portion = ground area illumin-ated by back port beam
Forward port beam
Beam width = 3½deg
d portion= d area illumin- by forward ard beam
The arrows indicate the small portion of the beam which is deflected back to the aircraft receiver
Shaded portion = ground area illuminated by forward port beam

general principles of the Marconi Doppler Navigator. The aerial system radiates two beams, one projected forward and ward, and the other backward and downward. Additionally, one beam is displaced to the starboard of the aircraft track while the other is displaced to port, the positions being switched twice a second.

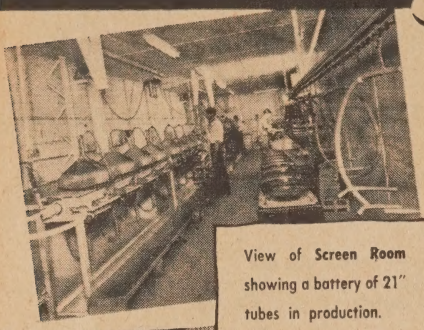
and the high-flying jets which will be coming into service before long.

is immune to weather conditions and to such handi- fading and static interference.

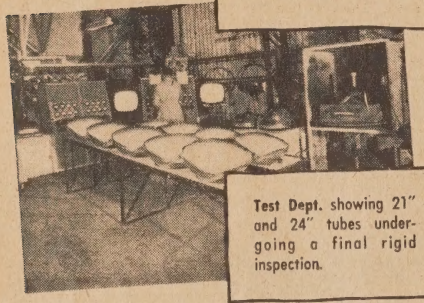
ppler tackles the basic problems of air navigation at by providing, for the first time, direct and continuous ation on the aircraft's ground speed and drift angle. two fundamental requirements can, if desired, be fed computer together with the airspeed (from the instru- ystem) and the aircraft's heading (from the gyro-mag- ompass) to give a continuous presentation of position. distance run and distance to go, windspeed and direction and so on — in fact, all relevant navigational data.

The accuracy of the Doppler equipment proper (that is, the electronic component) is extremely high. In practice the compass accuracy is a limiting factor; nevertheless, the overall accuracy of the aid can be better than 1 per cent of distance run along and across track, using a heading reference of plus or minus ½ per cent. The error introduced thus increases (in terms of linear measurement) with distance flown, but this aspect can be offset by occasional positional corrections from external sources.

Your Eyes — will make you Screen wis



View of **Screen Room** showing a battery of 21" tubes in production.



Test Dept. showing 21" and 24" tubes undergoing a final rigid inspection.

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these conditions, and using a speci-
calibrated compass, a series of 300-
cal mile flights by the R.A.F. at an
ude of 5,000ft showed that the
tant navigation error along the
was nil, while at right angles to
route an average error of 1.1
cal miles was recorded.

ALL ERRORS

ights made from Britain across the
h African desert areas (approximate-
,000 nautical miles) at altitude of
0ft produced an error of only 3.7
cal miles along the route while the
ge error at right angles to the direc-
of flight was 4.86 nautical miles.

e principle underlying the opera-
of this equipment dates back some
years, when the Austrian physicist,
tian Johann Doppler, first drew at-
on to the fact that when an object
ing sound waves (the classic
ple being a locomotive's whistle) is
aching an observer at speed, the
ency or pitch of the sound as
by the observer is higher than that
lly being emitted.

nversely the frequency apparently
below its true value with a sound
e which is receding from an ob-
r, in either case the amount of
ge of frequency is in direct relation-
to the speed at which the source
velling.

tually, Doppler did far more than
for he also put forward the hypo-
that the same sort of effect should
oted with light waves, although it
eft to Fizeau to prove that this was
d the case. From this it is only a
step to the realisation that the
pler shift" should also apply to
waves, which (like light waves) are
o-magnetic in character.

apparent lack of commercial
ation prevented the Doppler effect
being more than a scientific
ity for over a hundred years, and
nly in recent times that the prin-
has been exhumed from its text-
grave.

IN GUN-LAYING

aracteristically, perhaps, the first
cal employment was in gunlaying,
ore recently it has been used as a
of discrimination between fixed
oving "echoes" on radar screens.
the principle has been successfully
d to air navigation.

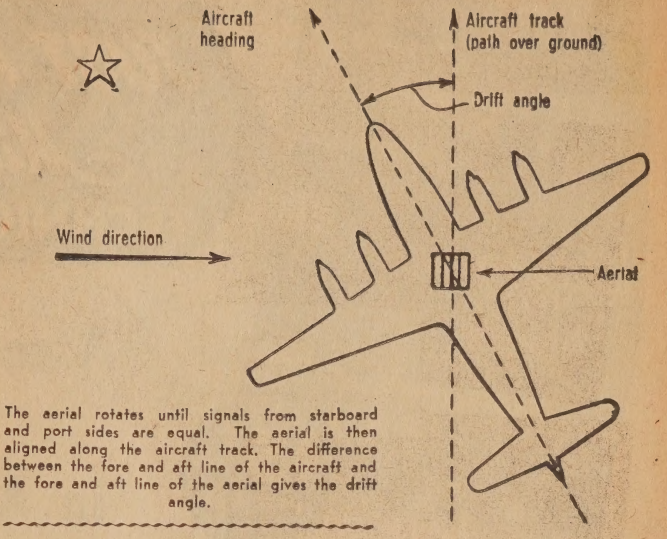
re are many possible variants in
y this can be done, and it is pro-
to describe briefly only one of
a British equipment designed es-
ly for civil aircraft.

small transmitter aboard the air-
generates a continuous radio wave
frequency of 8,800 Mc/s. This is
the aerial system, which shoots it
ward in two beams, one forward
ne backward of the aircraft. On
ng the ground these beams are de-
and scattered by it, a small pro-
n of each bouncing back to be
up by receiving equipment in
rcraft.

v, if the latter was hovering, the
ncy of the two return signals
be unaltered. But as the aircraft
motion, the return from the for-
ooking beam will be higher in
ncy than the original, while that
backward-looking beam will be
due to the Doppler effect.

measuring the difference between
o return frequencies, a third one,
in this context as the "Doppler"

HOW THE DRIFT ANGLE IS OBTAINED



The aerial rotates until signals from starboard and port sides are equal. The aerial is then aligned along the aircraft track. The difference between the fore and aft line of the aircraft and the fore and aft line of the aerial gives the drift angle.

frequency, is obtained. The greater the aircraft's speed over the ground the higher the Doppler frequency; and so from an evaluation of the latter the ground speed can be accurately derived.

To determine the angle of drift, one beam is additionally displaced to port, while at the same time the other is displaced to starboard, the displacements being switched twice a second. The Doppler frequency is derived by subtracting one pair of return frequencies and comparing it with that obtained from the opposite pair.

From this comparison, the drift angle is derived.

In order to see how this works, let us assume that the aircraft is travelling over the ground, not crab-wise, but in exactly the direction in which its nose is pointed (that is along its fore and aft line).

The compared Doppler frequencies will, in these circumstances, be exactly equal.

EFFECT OF DRIFT

Any drift caused by a side wind will, however, destroy this equality by an amount dependent on the angle of drift.

In practice, as soon as the equipment detects any inequality, the aerial system is automatically slewed until conditions of frequency-equality are restored, the amount of rotation being translated into terms of rotation of a shaft in the computor, this amount being equal to the drift angle of the aircraft.

Perhaps the mention of the word "computor" conjures up a mental image of rooms full of electronic equipment. But this is far from the truth, in the case of this particular Doppler frequency, for the computor can be easily tucked under one arm. Analogue methods of computation by an electro-mechanical system are employed.

Of particular interest is the means used for measuring the Doppler frequency. This is carried out by a phonic wheel, a device which generates an electrical sine-wave, the frequency of which depends on the wheel's speed of rotation.

The Doppler frequency is used to control the speed of this wheel, and the speed then becomes a measure of the Dopler frequency.

By interpolating suitable reduction gearing between the phonic wheel and the appropriate indicators, direct readings of ground speed and distance flown are given.

MEMORY DRUMS

A comparison between the Doppler frequency and the phonic wheel frequency is also used to control (via a drive motor) the rotation of the aerial for drift angle measurements.

Memory drums are incorporated in the computor to enable a positive "fix" from another source to be fed in without introducing inaccuracies into the mileage run indication. During the period of time taken to feed in the independent fix, the mileage run is stored on the drums, to be fed automatically into the counters when the equipment is switched back into the run position. Should the ground speed vector fail, computation continues, using the last known ground speed and drift angle.

It is hoped that in this brief outline of air navigational requirements, and Doppler navigators, enough has been said to show the potentialities of the new equipment. Not the least important of its attributes is the promise it holds out in the matter of automatic navigation.

It may well be that in the aircraft of the not too distant future, routine navigation will be carried out by Doppler equipment feeding information into an auto-pilot system, with the pilot himself in a purely supervisory capacity.

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TWIN CHANNEL RECORDINGS SOON

OW THE 45-45 UTTING HEAD PERATES

ogress towards the stereo- ionic disc is proceeding rap- ly, and reports indicate that eady records of this type are ailable in limited quantities in e U.S.A. Major companies e planning for releases later is year, but even now equip- ent is coming on the market. e stereo future seems likely to be a major event.

special interest in this issue are these pictures of the new stereo- record cutting head which, devel- by Westrex in U.S.A., seems cer- to be the type used for making the try's newest contribution to the art corded sound.

ey show more clearly than has been ble to date just how it operates. will be seen that the cutting stylus, has a tapered shank, is mounted socket at the end of a metal tube. ne same point is attached a pair of g arms actuated by the coil as- lies which move the stylus along ary axes set at 90 degrees to each . These arms are stiff longitudin- but can flex in a sideways direction at the stylus can follow a pattern is a combination of the move- of both arms.

ch drive unit, both of which work st a common magnet circuit, has oils, a driving coil mounted nearest e stylus, and a feedback coil be- it.

STYLUS

e stylus carries a heating coil gh which a current is passed in dance with the standard "hot sty- technique. Heating the stylus al- a much cleaner cut, and greatly es noise as against that produced cold cut.

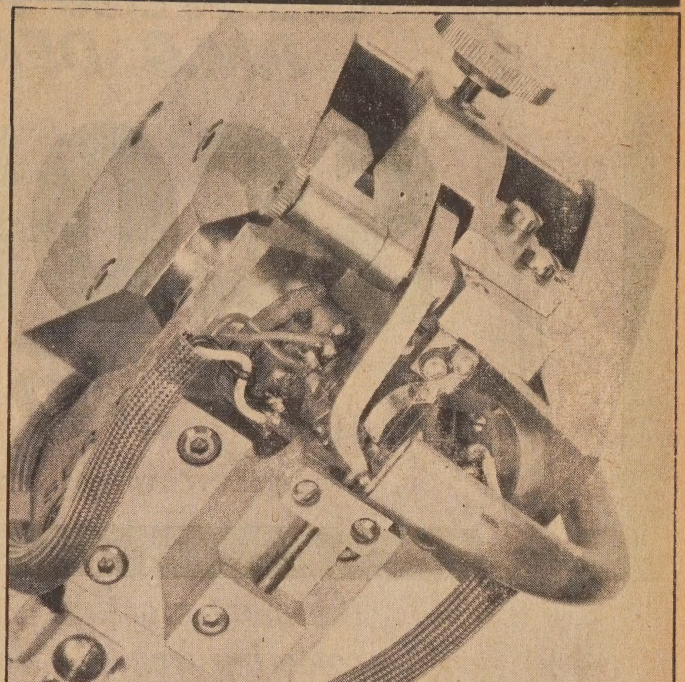
e head is a low impedance type. mpedance of the driving coil be- 1 ohms and that of the feedback 6 ohms.

amplifier with an undistorted out- f 75 watts is used to operate the the standard circuit including four output valves.

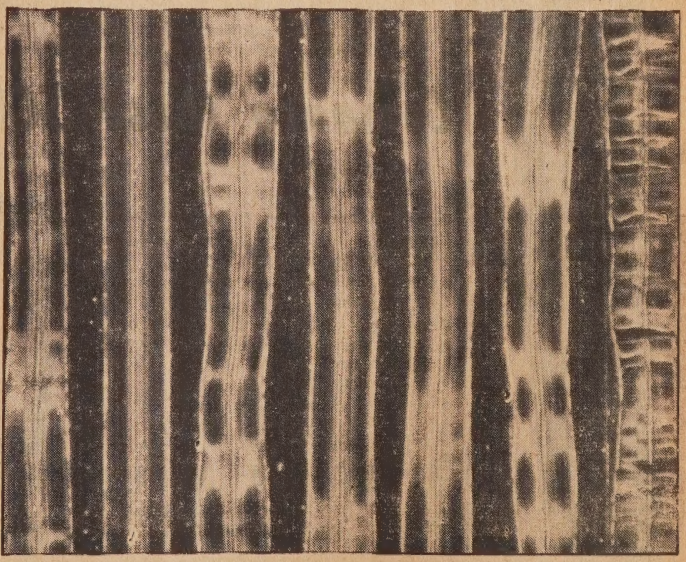
ost of the damping for the move- appears to be provided by the feed- circuit, for without it the response shows a peak at about 1 Kc., fall- way each side of this figure. With pplication of 20 db. of feedback suitable circuit, the response is ned so that the constant velocity ase is substantially flat between 40 and 15 Kc.

1 Kc. an input of 1 milliwatt cor-

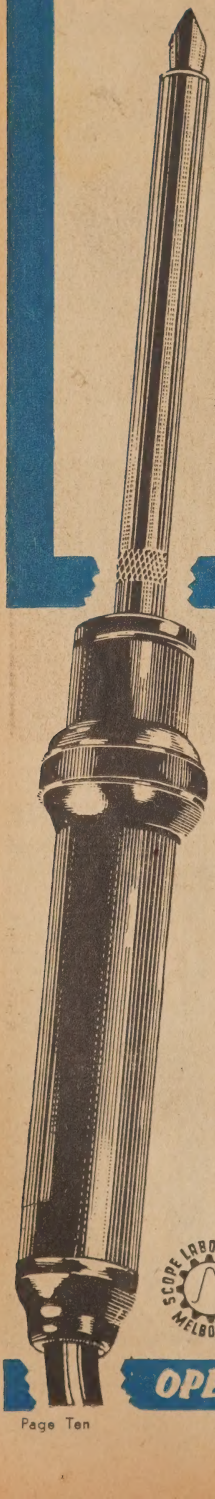
(Continued on Page 11)



This close-up of the cutting head shows the two drive units mounted at right angles to each other, linked to the torque tube which carries the cutting stylus. Near the tip is the advance ball and its adjusting arm, also the mouth of the exhaust tube for the swarf. Note the fine wires to carry the heating current for the stylus coil.



Close-up of a micro-groove disc made with the stereo cutter. Variation in depth and differences in the cut of each side wall are apparent, particularly in the groove at the right.



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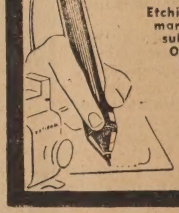

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STS indicate the system can, in one year, save the government 250,000 ars worth of special cleaning chemi- and 160,000 in supplementary labour s. Present cleaning methods on one icular model require approximately nan-hours per jet engine.

he sonic cleaning installation is ex ed to cut this time to about six man- s per engine.

he tank already has "sound-scoured" components of hundreds of in-ser jet engines ranging from the small- ittings to the largest structural mem-

ne engines are dismantled for clean- The parts are immersed in the tank solution of tap water and mild com- cial detergents. Sixteen modules of ric powered "magnetostrictive" trans- rs arranged in two rows around the force sound waves throughout the area.

/ITATION

rough a phenomenon known as vation, the liquid is literally torn , forming millions of invisible vac- or vapour bubbles which collapse r the sound pressure, releasing in- n frictional energy which attacks and away dirt, carbon, grease and other minants from the materials. It does affect the metal itself during the ing process.

Snic cleaning can remove the con- minants from many parts that now re- ih mechanical cleaning processes n erode the surface of the materials. nerosion could decrease the efficiency licately balanced rotors, blades and h precisional engine parts.

Sndard techniques include the blast- g f these parts with powdered wal- t nells, seeds and rice, and the use of olile materials which occasionally nice smog-making hydrocarbons and xity.

NEW process, known as "Serseal" as been introduced by I.C.I. to ce fumes and steam in metal treat- n baths. A reduction in fuel usage a) achieved. It invoives sealing the rface of the liquid used for process- g n the bath with a layer of inert aterial, thus cutting down the amount fat needed to keep the bath at a lis tory working temperature. Fuel ormies ranging up to 75 per cent ve been achieved without alteration th existing processing tanks.

SPACE MAN TRAINS ON GROUND

In order to study the behaviour of objects and people operating in a near vacuum, this tank has been built and tested in USA. Its degree of vacuum is so good that electronic valves work in it without an outer bulb. Wearing a flexible pressure suit, the occupant has a safety cord attached to his suit to avoid an accidental fall which might break the glass in his headgear.

. . HOW STEREO 45-45 CUTTING HEAD WORKS

(Continued from Page 9)

responds to a recorded velocity of 5 cm. per second, at which condition maximum feedback operates.

Distortion figures are claimed to be comparable with those now obtained with conventional lateral-type cutters.

Depth of cut, which is adjustable by means of the knurled knob at the front of the head, is controlled by an advance ball which rests on the disc just ahead of the cutting point. This ball is carried by an arm which is clearly visible in the photographs.

The flattened tube, the mouth of which is at one side of the stylus, is connected to an air exhaust, and carries the swarf away from the point as the disc is cut.

In the microphotograph of a disc cut with this head, both lateral movement and varying depth of cut are easily detectable. One of the grooves also shows clearly the difference in the pattern each side of the groove, corresponding substantially with the difference in information supplied by each section of the cutting head.

The groove itself has a maximum width of 3 mills, and the maximum number of lines per inch is 225.

There are naturally many other design points essential to the operation of the head, but no information on these is available at the moment.

Because the stylus movement is the resultant of energy supplied by both driving sources, suitable phasing of the coils will result in either a pure lateral or a pure vertical cut, and any combination of these. The head can therefore be used to make standard lateral records if desired. It will also accomodate any technique involving differences in the nature of the signal supplied to either head so that any variation likely to give the best stereo effect is possible.

It seems quite certain now that this type of head will be used in preference to the vertical-lateral type, mainly because it is much easier to obtain good balance between the channels in the distribution of noise, susceptibility to rumble, and distortion.

*

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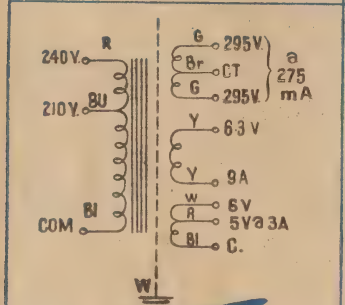
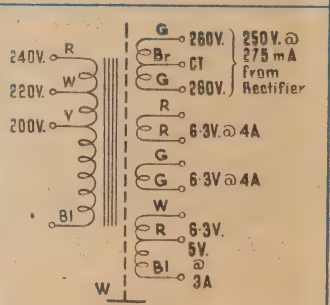
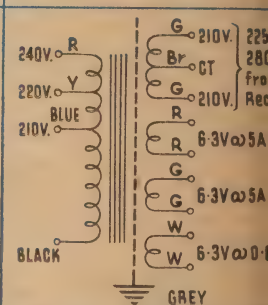
NATIONAL TV TRANSFORMERS

* RH275/295	TV275/260	TV280/210
		

With indirectly heated rectifiers volt at cathode of rectifier is 225 volts D

as used in R. & H. TV Receivers featured May, 1957 (17in) and September, 1957 (5in and 21in).

TECHNICAL FEATURES

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COUNT DOWN FOR MISSILE FLIGHT

ENSE SCENES AS ERO HOUR EARS

Before an intercontinental ballistic missile slides vertically way from its launching pad, ours of detailed checking must e ticked off in what is known as ne "count down." Here's how ur New York staff correspondent saw a recent American missile launching.

ERY hatch, valve and petcock in the 10-storey-high rocket has to be ntely inspected as the count-down resses, up to the minute when the g button is pressed — at "T minus "

t the United States Missile Test re, in Cape Canaveral, the dramatic t down for a typical missile begins T minus 660," 11 hours before the stage rocket of the missile is trig- d.

ie count-down is conducted by the s manager — much like a musician ucts a symphony orchestra. The test ager's baton, however, is a radio set; his score, the count-down er plan.

ie field test manager and his launch- crew are linked by intercom radio. e is also a "squawk" box, for an- ncements affecting the whole area.

CREW WAITS

ie test crew sit over their consoles closed circuit television screens in a ete and steel blockhouse, 750 feet the pad. They smoke cigarettes and coffee out of paper cups as the u-down begins — "This is missile X ng up on minus 660. Let's go."

ie first motions are unspectacular. ates are connected, computers are ned on, fuel trucks wheel out of garages.

the checks increase in their im- nce, tension increases in the block- u. Reporters with binoculars gather ie nearest permitted vantage point. ographers with telephoto lenses set eir cameras.

A T minus 430, all vehicles are ed clear, except an ambulance, a ruck and a lorry loaded with the late hydrogen peroxide for the rocket ts.

Ish boats move out into the bay ud Cape Canaveral to clear the ir area of all shipping. Tracking ati is strung out from the cape to ne Ascension Island more than 5,000 le away report in by radio. At T in 260, the report comes in: "Range and ready."

the event of a flaw uncovered by metabled checks the count down

Engineers gently ease the nose cone of a 72ft Vanguard test rocket into place at Cape Canaveral. The earth satellite rests at the top of the third stage of the rocket inside the base of this cone.

stops. It will not resume until the flaw has been remedied.)

The tension increases. Nobody smokes any longer. At T minus 125, the word is: "Missile X coming up at 125 and counting. All personnel—caution. We're going to start loxing." Five minutes later liquid oxygen, the oxidizer for the fuel proper, begins to flow into the rocket and a frosty white vapour climbs away from the launching site.

FINAL SECONDS

All personnel are ordered off the gantry that stands beside the missile, and from which early checks have been made. The gantry rolls clear. An hour before firing time, all have evacuated the pad except the firing crew. They will set the rocket motor's igniter mechanism and clear the pad before T minus 30. A telephone line is opened to Washington.

At three minutes, the count down goes to seconds and is counted off in 10 second intervals. Then single seconds. Lines are disconnected. Heaters turned off, instrument recorders switched on. Four . . . three . . . two . . . one . . . fire!

The firing button is depressed. All eyes watch the pad.

In the next few seconds, control has passed out of the hands of the men behind the shock-proof windows of the blockhouse. For these few seconds, an integral automatic cut-off will check the trigger mechanism if a dangerous situation develops. These seconds pass.

THE MOTOR FIRES

With a flash, the priming fuel ignites. Gradually the motor gathers thrust, the sound gets shriller. Then, imperceptibly at first, the monster begins to lift — then faster.

As the straining crew gazes at the flaming canister it rises with increasing speed and climbs toward the stars. The count-up begins.

And crewmen light up cigarettes and move to the cafeteria.

The miracle of colour represented this perfect dahlia bloom would no possible without the impact of ligh plant cells.

The Light Factor In Plant Lif

Light is an essential factor in the growth of all living things on the earth's surface. It giv colour to the flowers and vitality to trees. All this is accomplished by a complicated and i genious chemical action typical of so many found in nature.

The mysteries of the action of light on vegetation are gradually being unravelled with possible beneficial results to agriculture.

Everyone likes a garden. Poems and songs have been written about them. Millions of people spend an enormous amount of time making or trying to make a garden. Governments and councils give parks and gardens top priority in their affairs.

Now this doesn't mean that everyone likes gardening. As a matter of fact most people I know only have a garden for a couple of reasons. Firstly to make a space for the wife to walk about when hanging out the clothes and secondly because the next door neighbour can invoke the Noxious Weeds Act against you.

Gardening is all right perhaps if you haven't got a TV set.'

Watching the sport on a Saturday afternoon is important and you can't have a TV set outside like you can a radio set. You can have music while you try to work but it is confoundedly awkward to watch pictures while you work.

Another thing that a lot of people don't like is the fact that the nocturnal prowling after slugs, snails and other pests interferes with the program. In the middle of "I Love Lucy" or an exciting western it is very annoying to have the wife remind you that slugs may be attacking the newly planted lettuce or asters and you have to go snooping around with a torch with poisoned bait.

I don't mind doing a bit of tidying up during the day but I'm hanged if I like working on it at night as well.

Nevertheless a garden is something which can be very interesting if seriously and the fact that fellows countless scientific books about it to indicate that there is someth it. Which reminds me that I an posed to be writing about the of light on plants.

Probably the greatest myste nature has been, and still is, what light to stimulate a plant to t carbon dioxide from the atmos release oxygen and convert the dioxide into substances such as and starch.

The youngest schoolchild has taught that it is a green substance chlorophyll in the leaf of a plant which the light acts to bring abo result by a process known as synthesis.

Nowadays, of course, chlorophy a new meaning. A child could give a definition of chlorophyll green stuff in toothpaste which to with a new substance KP3 pr tooth decay and bad breath or the stuff in the lollies which daddy so that mummy won't catch on t has been down to the corner way home from work.

RECENT THEORIES

Although the process of pho thesis has been known for a long time it is only in recent years tha headway at all has been made i ravelling its mysteries. Even toc still remains a mystery but at research has brought about some ries which are more tenable than tofore.

The subject of photosynthesis complicated and the detail so co

The synthesis is, of course, the in of water and carbon with the duction of oxygen and carbohy such as starch and sugar.

This process is almost exclusi green plants and can only be br about in the presence of chloro This is the agent which captures nous energy and transforms and it in the form of chemical ener can occur only in a living plant presence of light. Chlorophyll ext from a plant does not exhibit any synthetic action at all. In fact it to decompose under such conditio

Some plants require very little for photosynthesis to take place

hensive that it is not proposed into the matter here except to m a few interesting facts about it.

The word photosynthesis is a bination meaning light and syn

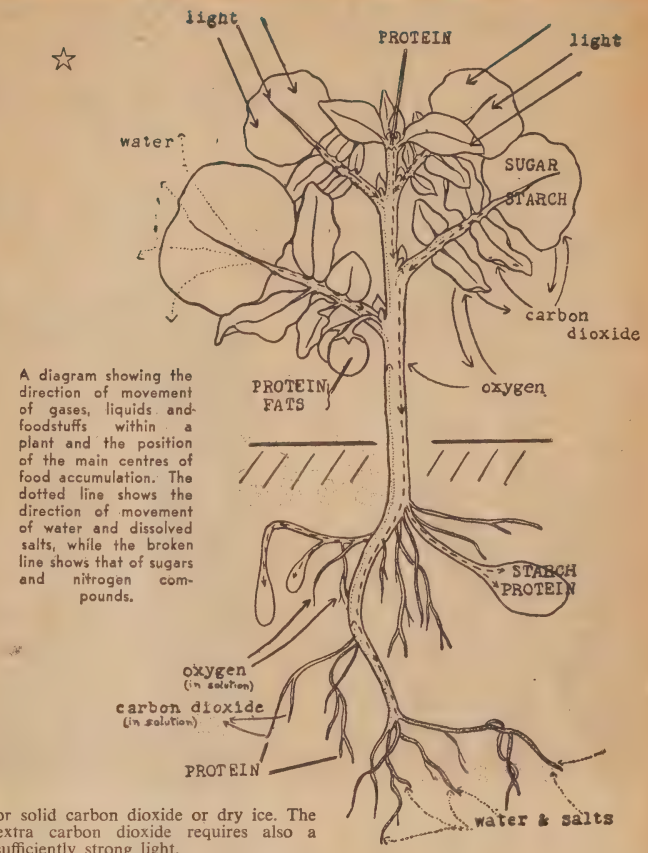
ance some deep-water algae are
ed in light of an intensity no greater
moonlight and photosynthesis takes
e. The carbon dioxide is derived
n the water.
here are also forms of green mosses
ch exist in dark caves under con-
ons of not quite total darkness but
ch carry out photosynthesis. These
ts have a surface layer of cells in
form of lenses which are believed
concentrate the available light onto
chlorophyll within the plant.
here are other plants which must
e a great amount of light for photo-
hesis. Plants which live in the open
wheat, oats and other cereals are
mples of this type.
ther plants like less light, Forest
ts and those which live better in
houses are examples of these.
ther plants like the eucalyptus and
ordinary bean adapt themselves to
the optimum amount of light. This
ione by the turning of the leaves.
ing the morning the leaves spread
nselves flat on to the sun but at
day they present themselves edge on
that the rays cast no shade and the
ntity of light falling on the surface
the leaf is at a minimum. That is
a eucalyptus tree is not a good
for shade in the heat of the sun.
can't lie beneath a bean plant any-

hotosynthesis depends on two fac-
other than light. There must be a
er supply of carbon dioxide and
temperature must be correct.
ack of adequate light, carbon dio-
or the right temperature has an
rse effect upon the process of photo-
hesis.
has been shown experimentally that
e is an optimum amount of light
h is needed for photosynthesis to
l place.
ants were placed in an atmosphere
cially enriched with carbon dioxide
at the right temperature. When light
absent photosynthesis did not occur.
the gradual admission of light the
ess increased in proportion to the
nt of illumination but as the light
sity increased the rate of photo-
hesis increased more slowly until a
was reached where a further
ase of light had no effect and full
osynthesis was stabilised.
rmally the maximum photosynthe-
s curs at very low illumination. Some
rs like wheat need light which is
imes lower than full sunlight.
high latitudes where the days are
crops can be grown at a greater
el than in lower latitudes where the
y are shorter.

IGHT AND GROWTH

seems that it is the light factor
mbination with the carbon dioxide
nt and temperature which deter-
irs which crops can be grown in
rtain climates. Each plant requires its
n peculiar conditions relative to the
re factors light, heat and carbon
oxide.
A the same time an increase of
rbon dioxide requires a stronger light
tect adequate photosynthesis.
Ts effect has been made use of in
cr sing production by keeping the
ar in glasshouses or frames and
ri ing the carbon dioxide content
tificially either with rotting manure

CHEMICAL PATTERN OF GROWTH



A diagram showing the direction of movement of gases, liquids and foodstuffs within a plant and the position of the main centres of food accumulation. The dotted line shows the direction of movement of water and dissolved salts, while the broken line shows that of sugars and nitrogen compounds.

by Calvin Walters

or solid carbon dioxide or dry ice. The extra carbon dioxide requires also a sufficiently strong light.

It appears that only light in the visible spectrum or close to the ultra-violet is used by plants in photosynthesis. Cultivation of plants is quite effective under artificial light particularly fluorescent tubes using neon gas.

We will not go into the very complex chemical theories which are now being put forward to account for photosynthesis. It does not seem an impossibility that the true action of the process will be explained in the near future.

There are two other important phenomena of plant growth which are related to the action of light. These are respectively Phototropism and Photoperiodism. They have nothing to do with religion or politics.

The former is the well known effect of a plant's stems and leaves orientating themselves to face the source of greatest or more favourable illumination. With an indoor plant it is often necessary to turn the plant during the day in order to gain a uniform growth.

This orientation towards the favourable light is caused by unequal growth on one side of the plant.

Plants grown in the shade have a greater rate of growth than those grown in the light. Thus when a plant is in a position where light shines on one side only this side will grow less quickly than the side in the shade. The shaded side will therefore stretch, as it were, itself over the other side and the plant will bend towards the lighter side.

Plant stems therefore are directed away from areas of low illumination to those with more.

In order to ascertain whether Phototropism depended for its effect on an particular wavelength of light an experimenter named Johnston tried some stunts in 1934 which threw some light on the matter. (what an unintentional pun to make.) (Awful, too—Ed.)

This Johnston chappie took a young plant of oats and illuminated it on one

(Continued on Page 17)

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with blue spectral light and on the
with green spectral light. By doing
he was able to observe to which
the young plant leaned. If it leaned
rd the blue light it proved that
light had the greatest influence in
ding growth.

reducing the intensity of this parti-
light or increasing the other a
ure of the retarding influence was
ned. By placing a fresh plant
een the lights and continuing the
dure until bending of the plant
stopped a stage was reached when
action of the two lights were
ced. The energy of the lights was
measured and a curve
ned which showed
the phenomenon of
tropism was depen-
on blue or violet light
s action.

has been found that
is of substances called
n" which is present
e tips of the coleop-
of young oats pro-
an effect similar to
tropism.

is auxin can be col-
by cutting the tip
a coleoptile of a
oat and applying
a piece of gelatine.
atter will collect the
If the gelatine is
pplied to the side of
at stalk from which
p has been removed
tem will grow more
e side to which the
ne is attached.

s this is the reverse of the action
ht which retards the growth. It
rs that in some way the application
ue or violet light retards the pro-
on of auxin on the side to which
applied. Thus the retarding action
e obtained on any individual part
plant.

third important effect of light on
growth has to do with the length
e daylight and is called "photo-
ilism." It has more practical appli-
is as will be seen.

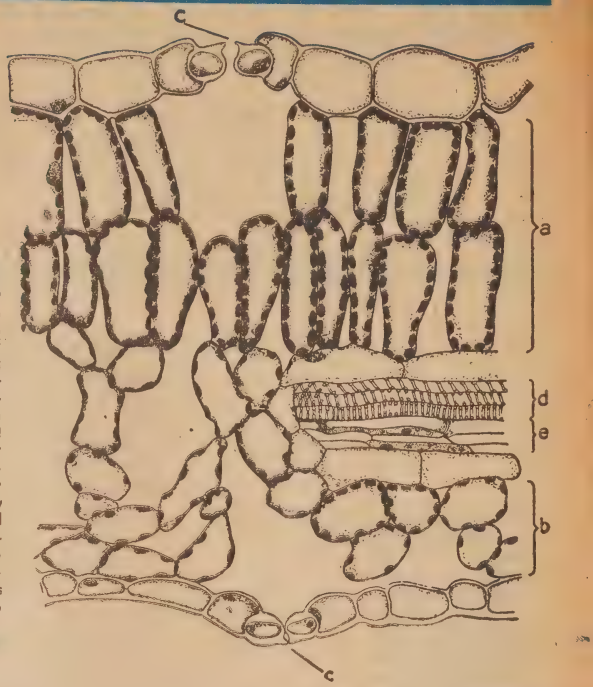
MUCH LIGHT

A mentioned above, light must be
e to a plant in just sufficient quantity
ormal growth. If given in excess
r things are likely to happen.

t s manifestly possible for a plant
ve the same amount of light in a
er of different ways. We can give
rong illumination for a few hours
llow this by a long night or we
pply a less amount of light for a
eriod followed by a short night.
Hever the growth of the plant will
the same. It may be found that
f these conditions will prevent a
from flowering or an onion will
oduce an onion. A tree may not
s leaves and go right through the
or succumb to frost.

Y the same plant will behave quite
lly in the same location when
p d with the right amount of light.
T phenomenon of photoperiodism
st bathed in mystery but because
its economic importance it is probably
ne studied more than any other
tc in plant growth.

TYPICAL SECTION OF LEAF CELLS



Vertical section of rhubarb leaf showing—a and b, mesophyll; a, palisode, consisting of two layers of cells; b, spongy mesophyll; palisode and spongy mesophyll; both contain numerous chloroplasts (shown in black); c, stomata present in this leaf in both upper and lower epidermis. Notice the large intercellular spaces formed immediately behind each stoma; d and e, vascular bundle; d, kylem, e, phloem; a bundle sheath of living cells without chloroplasts surrounds the bundle and links it to the assimilating cells.

During experiments some curious results were obtained. For instance two chrysanthemums were cultivated in identical soil during a period when the day was short and the night long.

Both were illuminated during the day with natural daylight but at night one plant was illuminated for a few extra hours with an electric lamp while the other was in darkness. The plant with the extra illumination failed to flower. Even extra illumination with a stronger lamp for only half an hour a night caused the plant to fail in flowering.

If, however, the plant is covered with a black cloth at five o'clock in the evening and removed at about seven o'clock in the morning thus lengthening the night artificially it will flower earlier. This process is being used in some countries to advance the flowering period by anything from one to two weeks.

To be really effective this method must be carried out properly with screens which will reduce the illumination to one ten thousandth of the normal.

It has been found that a chrysanthemum requires an uninterrupted night period from twelve to sixteen hours if it is to flower, the actual period required depending on the variety.

SHORT AND LONG DAYS

There are plants which require long days, plants which require short days and others which don't care what day it is or how long.

The poinsettia is a short day plant as is also the Mammoth tobacco plant of American Maryland.

Among the long day plants are included nasturtium, China aster, Centaurea cyanus. Correct temperature is also important.

A curious feature of the China aster is that it will flower only with long days if the temperature is below 24 degrees centigrade. Above this temperature it doesn't care how long the day is.

Plants which are not affected by the length of the day include lupins, browallia and Buddleia.

It would appear that it is through the adult leaves that light has an influence on flowering. This was shown by covering with a black cloth only the lower portions of a chrysanthemum plant and leaving only the terminal buds where flowers appear, exposed to normal light. The plant flowered early just as though the whole of it had been withdrawn and given an extra long night.

DARK PERIODS

On the other hand if only the terminal buds are covered thus leaving the lower adult leaves exposed to normal length of light early flowering failed to take place.

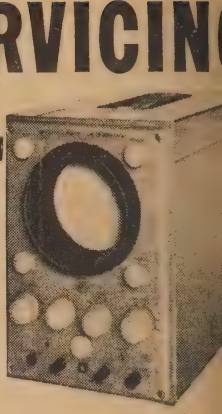
It has been shown that it is the red radiations of the light spectrum which seem to have the greatest influence on the process of photoperiodism. On long day (short night) plants, the orange red, red and extreme red stimulates flowering while green, blue and violet rays and the infra red have no effect whatsoever.

On the other hand on short day (long night) plants, the red radiations suppress flowering.

A theory has been advanced to explain at least the necessity for long nights required by the chrysanthemum.

(Continued on Page 105)

FOR EFFICIENT TV SERVICIN



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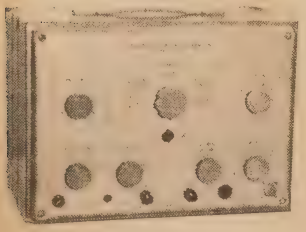

A.W.A. TELEVISION SWEEP GENERATOR — A56036

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Technical Review

BUILT-IN ION TRAP PROTECTS CATHODES

Ve are familiar with the use of ion traps in cathode ray tubes because ith these tubes damage from free ions can be very great. Not so often et with is ion control in smaller valves. As this article shows there is vidence that heater life can be appreciably extended by adopting control principles to such valves.

NGER life for oxide-coated cathodes is made possible by a -in ion trap. Limited quantities of -voltage pentodes have been con- ted with the ion trap and have life s in excess of 2,000 hours.

ie special pentode was developed for ecial high-voltage switching opera- for use with the Kaiser-developed cathode-ray tube. Other applica- may be in high-voltage triggering, ping, mixing and shunt regulation.

ns, created by collisions between rons and residual gas molecules, are uctive to oxide-coated cathodes. The lem becomes more acute with r voltages. In addition, mica sup- and other insulators may develop ge paths as a result of positive ion ardment.

CIAL CARE

minimise the problem, special pre- ions must be taken in the fabrica- of high-voltage tubes with oxide- d cathodes. For instance, the bake- pumping and gettering procedures be made more thorough.

Alternatively, destruction of the cath- at high voltages mightly be largely ded by replacing the oxide-coated de with a tungsten or thoriated- ten emitter. However, such cathode rials imply the use of much higher ent temperatures and of more com- fabrication procedures.

the new pentode an ion trap is provided by which positive ions are prevented from reaching the cathode. An indirectly heated, oxide-coated cathode is surrounded by control and screen grids in the conventional manner as shown in Fig. 1. A cylindrical collector, open at one end, surrounds the screen grid and is connected to it. Thus, in the absence of plate voltage, an essentially field-free region is created in the interspace.

The plate is located opposite the open end of the collector electrode. The electric field of the plate penetrates the space between screen grid and collector, causing the electrons drifting there to be deflected to the anode. Their number is determined by control-grid potential as usual.

SHIELDING FLAG

Positive ions created in the anode region are deflected downward toward the bottom of the collector, rather than to the screen grid or to the electrodes inside the screen. This is because the positive ions travel with a velocity whose downward component is much larger than any horizontal component.

The only region in which positive ions can reach the cathode itself is at the end of the cathode directly opposite the plate. A small flag electrode, internally connected to the cathode, serves to prevent the entry of positive ions into the cathode region from this direction. The flag also performs the function of a corona shield.

Experimental models of the pentode were operated at 15 kv with a screen and collector voltage of 100v. Control-grid voltage is — 4v and typical plate current is of the order of 0.6 ma. Maximum plate dissipation is 20w, screen dissipation is 0.7 w and collector dissipation 5w. Maximum cathode current is 10 ma.

Mutual conductance is about 600 micromhos and input and output inter-electrode capacitances are 7 and 3 micro-microfarads, respectively. Heater voltage and current are 6.3v and 0.13 amp., respectively.

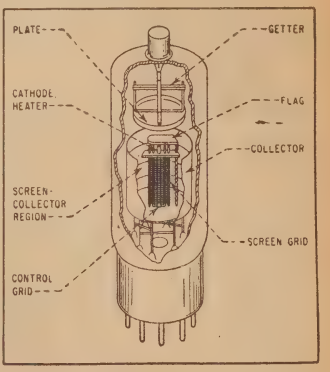
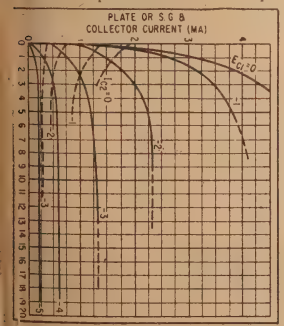


Fig. 1.—Collector and flag of new pentode protect oxide-coated cathode from positive ion bombardment.



Fi 2.—Transfer characteristics with scen grid and collector at 100 volts nd 6.3 volts across the filament.

RUSSIAN ATOM SMASHER HAS HIGH POWER

SOME details have been revealed of the atom smashing machine that is now being designed at the Institute of Electrophysical Equipment at Leningrad.

It is to be a "proton synchrotron" of 50 Bev—in other words five times more powerful than the largest machine at present in existence, at Dubna, and twice as powerful as the machines being built at Geneva and Brookhaven.

Though the electro-magnet of the new machine will be 1,640 feet in diameter (that is, about six times that of the Dubna machine, which is 236 feet across) the weight of the magnet will be substantially less than that of its predecessor, 22,000 tons as against 36,000 tons. Likewise its electrical supply will not need to be so powerful—Dubna, 148,000 kW; Leningrad 100,000 kW.

The reason for this is that the designers are apparently making use of the technique of "strong focusing" which exerts the containing power of the magnetic field to prevent atomic particles leaving the prescribed path round the accelerator more economically than in conventional systems.

In the standard arrangement the magnetic field is so designed as to check "deviationist" particles vertically and horizontally throughout the length of the accelerator chamber. The "strong focusing" method in contrast concentrates the full strength of the magnet's containing field first vertically and then horizontally by alternate segments of the accelerator chamber.

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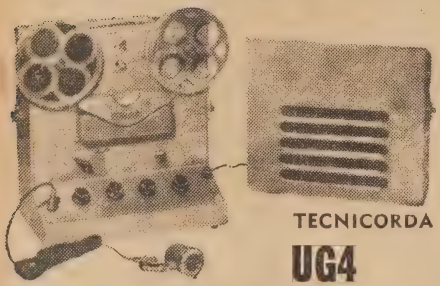

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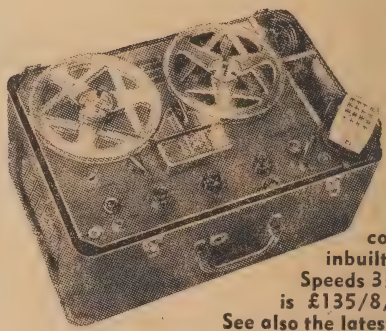

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2 speeds, twin track with in-built 7 valve radio. £155.

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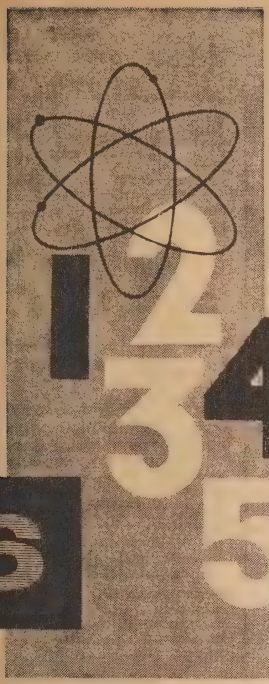

Basic Electronic Counting

RADIO AND TELEVISION NEWS

Electronic computors do not use our conventional method of numbering —they use the binary system by which numbers are based on a system of two values only—0 and 1. Here is a clear and simple explanation of the system and its elementary application to electronics.

one time, binary numbers were relegated to an obscure little corner he basement of mathematics. and of concern only to a few cloistered ematicians whose interest in such bers was largely academic.

day, the binary numbering system ed extensively in computers, elec- c counters, and automation equip-

the decimal numbering system, each of a number may have any of 10 ent values: 0, 1, 2, 3, 4, 5, 6, 7, 8, For example, 743,297 is a number ssed in the decimal system. In the y numbering system, each digit of nber may have either of two values: 1. For example, 1101011110 is a er expressed in binary notation.

the decimal system, the relative ions of the digits determine the of a number. The right-hand digit sents "ones," the next digit to the epresents "tens," the next digit re- nts "hundreds," the next "thous- " etc.

NARY AND DECIMAL

e decimal number 4632 therefore s 4 thousands, 6 hundreds, 3 tens, d 2 ones. In binary notation, the ve positions of the digits also deter- the value of a number. The right- digit represents "ones," the next to the left represents "twos," the digit represents "fours," the next s," etc. The value of each position uble that of the position to the im- te right.

binary number 10111 therefore sixteen and four and two and one. system of positional values is illus- te in Fig. 2. The binary equivalents eral decimal numbers are given in 1, for illustration.

In any machine used for counting or computing, each digit of a number is represented by a circuit or component. Fig. 3 shows how a group of switches, for example, can be used to represent either decimal or binary numbers.

When the numbers are to be expressed in decimal notation, each switch (or circuit) must be able to represent any of ten different conditions, as in Fig. 3A. When binary notation is used, however, each switch (or circuit) need be capable of representing only two different conditions, as in Fig. 3B. The resulting simplicity of the required circuitry is the reason for preference of binary notation in computing and counting devices. Some computers are designed to work with decimal numbers, but even in these machines each digit of the decimal number is usually represented by its binary equivalent.

Manually operated switches like those shown in Fig. 3 are not often used in practice, because it is desirable to make the operation of the circuit as nearly automatic as possible.

Table 1.—The binary equivalent of any decimal number is expressed as a series of "ones" and "zeros," as explained in text, with each "one" representing a given value according to its position. For illustration, several decimal numbers are given here with binary equivalents, showing derivation of the latter.

DECIMAL	BINARY	INTERPRETATION OF BINARY
5	101	1 + 4
7	111	1 + 2 + 4
12	1100	4 + 8
22	10110	2 + 4 + 16
35	100011	1 + 2 + 32
105	1101001	1 + 8 + 32 + 64

FEW RELAYS

Relays and stepping switches are used only sparingly because they cannot operate at the speeds normally required. Each switch shown in Fig. 3 would therefore be replaced by an electronic circuit. A circuit to replace each ten-position switch shown in Fig. 3A would require ten tubes (with some refinements, the number of tubes could be reduced). Each binary switch of Fig. 3B however, could be replaced by a circuit using only one double triode. This circuit, the flip-flop, is shown in Fig. 1. This same circuit is sometimes referred to as a binary scaler, bi-stable multivibrator, or Eccles-Jordan circuit.

Like the two-position switch which it replaces, the flip-flop circuit has two conditions—off and on. When the left-hand triode is cut off and the right-hand triode is conducting, the circuit is said to be in the off or zero condition.

When the circuit is in the opposite

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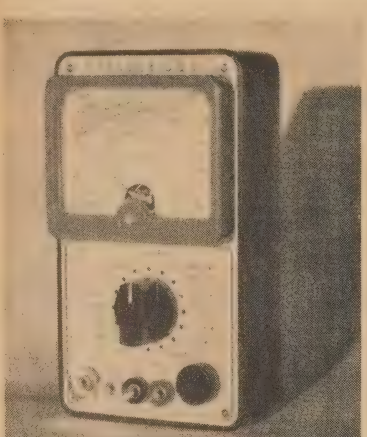

TESTER BOY MULTIMETER

The Tester Boy multimeter is ideal as a portable instrument for radio and TV servicing, is ideal for the hobbyist, motor mechanic, etc.

Dimensions are 6 inches high, 2 3-8 inches wide, and 2 5-8 inches deep.
Weight, 1lb 13oz.
Ranges as follow:—
Volts, AC and DC 2.5, 10, 50, 250, 500, 5000.
Resistance, 0-10,000 ohms, 0-100,000 ohms and 0-1 meg ohms.
Decibels, —20db to +10db.
0db to +22db.
By referring to a chart up to +56db may be measured.

The case is black bakelite with a metal panel and 3-inch meter. Test leads are provided and also a leather carrying case that holds meter and leads. Sensitivity of meter is 1000 ohms per volt.

Price of this unit is

£7-10-0

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7. **¼-inch dial spindles with bracket** for attaching to chassis. Well-known make. **Price, less flywheel, 2/9 Price with flywheel, 4/6.**
8. **2-Lug Mounting Strips, 1/- doz.**
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10. **Magnets,** originally used on loudspeakers. These are suitable for many jobs for the hobbyist. **1/- each.**
11. **3 and 5 mfd. 110 volts AC paper block condensers.** These are ideal for hi-fi speaker networks as both 3 and 5 may be connected in parallel giving a total of 8 mfd. at 400 volts DC wkg. **Price is 7/9 each.**
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14. **250 ohm Rheostats,** I.R.C. 25 Watt with mica and porcelain insulation. **Price only 4/6 each.**
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6 x 4 x 2	.. .. 7/
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10 x 6 x 2½	 12
11 x 8 x 2½	 14
13 x 7 x 2½	 14
13 x 10 x 2½	 17
17 x 8 x 3	 22
17 x 10 x 3	 25
17 x 12 x 3	 26

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Model EL 3517 fully imported recorders u 5in reels, tape play for 1 hour on standa tape, 1½ hours on L.P. tape, speed of ta 3¾ inches per second, frequency range 6(Kc.
Built-in 6 x 4 oval speaker.
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1 Watt carbon listed in ohms: 250, 350, 390, 400, 450, 500, 600, 680, 800, 1500, 2000, 3000, 4000, 4700, 5000, 6000, 7000, 10,000, 12,000, 15,000, 18,000, 25,000, 40,000, 56,000, 70,000, 75,000, .1 meg, .15 meg, .25 meg, .3 meg, .5 meg Price 4d ea., 3/- doz., £1 per 100

2 Watt Carbon listed in ohms: 100, 200, 470, 800, 4700, .4 meg, .47 meg, .5 meg. Price 6d ea.

20 Watt Wire Wound listed in ohms: 50, 75, 125, 150, 175, 20(250, 300, 400, 750, 1250, 1500, 1750, 2000, 4000 Price 2/- ea., 21/ doz

25 Watt Wire Wound listed in ohms: 50, 75, 100, 125, 175, 20(300, 400, 750, 1250, 7000, 7500. Price 2/6, or 27/- doz.

30 Watt Wire Wound: 1000 ohms, 2000 ohms These are 1 9/ resistors. 4/6 each.

50 Watt Wire Wound: 250, 2500, 10,000 ohms. 4/6 ea.

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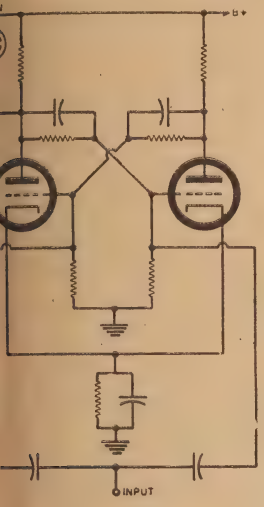
Fig. 1. In the flip-flop circuit, one tube is cut off while the other is nducting. Each pulse applied to e input reverses the circuit. When e circuit is in the "zero" condi- n (left tube cut off and right con- cting), the neon light is off. The ht comes on when the circuit is itched to the "one" condition.



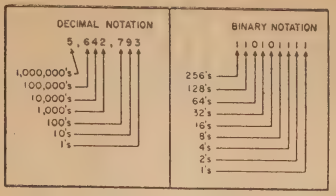
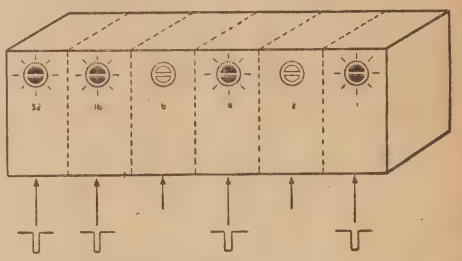


Fig. 2. In decimal notation (left), the digits represent, from right to left, ones, tens, hundreds, thousands, etc. In binary notation (right), the digits represent, from right to left, one, two, four, eight, sixteen, etc. The decimal equivalent of the binary number shown to the right is the sum of the quantities represented by the ones, which, in this case, total 431.

Fig. 3. By setting up switches in groups, it is possible to use them for representing and recording either decimal or binary numbers. However, in the case of decimal notation (A), observe that each switch would have to have ten positions. In the case of binary notation (B), on the other hand, the switches are much simpler, each one requiring only two positions. The switches in (A) are set to represent the decimal number 369. The switches in (B) are set to represent the binary number 11010, equivalent to decimal number 26.

Fig. 4. A binary number may be stored in a series of flip-flop stages. The binary number 110-101 (1 plus 4 plus 16 plus 32) is stored in the six flip-flops indicated. The assigned values of the neon bulbs that are lit add up to the decimal number 53. Numbers are recorded and stored by feeding pulses to appropriate stages.



-left-hand tube conducting and and tube cut off—it is said to be on or **one** condition.

many types of instruments, it is ary to determine (without remov- he instrument from its case) r the flip-flop is in the **zero** con- or the **one** condition.

this purpose, a small neon indi- is mounted on the panel of the nent and connected in the circuit wn in Fig. 1.

N INDICATOR

n the circuit is in the **zero** con- the left-hand tube will be cut d the neon lamp will be dark. er, when the circuit is in the **one** ion, the left-hand tube will be ting and the neon lamp will glow. he flip-flop circuit shown in Fig. h plate is coupled, through a re- to the opposite grid. It is for ason that one tube will conduct the other tube is cut off. If, for le, the left-hand tube is cut off, its oltage will be high.

high voltage, applied through the g resistor to the grid of the right- tube, causes the right-hand tube duct. If a negative pulse is now to the input, the right-hand grid driven to cut-off and the plate of this tube will rise.

increase of voltage, applied the coupling resistor, will now e he left-hand tube to conduct. The therefore reverses its condition me it receives an input pulse. If cuit is in the **zero** condition at rt, it will switch to the **one** con- when an input pulse is applied. nd input pulse will switch it back **zero** condition, a third input pulse switches it to the **one** condition again, and so on.

The circuit is quite similar to the cathode-coupled multivibrator used as the vertical or horizontal oscillator in many television receivers. In such sets, however, components are chosen to provide time constants that will alternately cause each of the triode sections to cut off and conduct, even when no pulse is applied.

Thus, a free-running oscillator is obtained whose frequency depends on the time constants chosen. In the flip-flop circuits used for counting, the triodes retain their condition of cut-off or conduction until they are signalled to change by an input pulse.

It is apparent that a group of circuits like the single one shown in Fig. 1 can be used to represent a binary number. For example, the binary number 1011 can be represented (stored) in a group of four flip-flops with the first, second and fourth circuits in the one condition, and the third circuit in the zero condition. (The first circuit corresponds to the right-hand digit of the a group or bank of flip-flop stages is known as a register.

The bank of six flip-flop stages shown in Fig. 4 can be used to store any binary number from 000000 to 111111. The six neon lamps in these circuits can be used to indicate the decimal equivalent of the binary number stored.

This is accomplished by assigning a value to each light. These values are often printed on the panel of the instruments shown in Figure 4. The lights, starting with the first circuit, are assigned values of 1, 2, 4, 8, 16, and 32.

The decimal equivalent of the binary number stored in the flip-flops is determined by adding up the assigned values of the lights that are on. For example, if the binary number 110101 is to be stored in the flip-flops, an input pulse would be applied to the first, third, fifth and sixth stages, assuming that all stages started in the zero condition.

The lights in these stages will now be on and their assigned values (1, 4, 16 and 32) add up to 53, which is the decimal equivalent for binary number 110101.

NEW LANDING DEVICE

THE Royal Aircraft Establishment in which so much British research is carried out may have a new device capable of safely landing aircraft in zero visibility by electronic means.

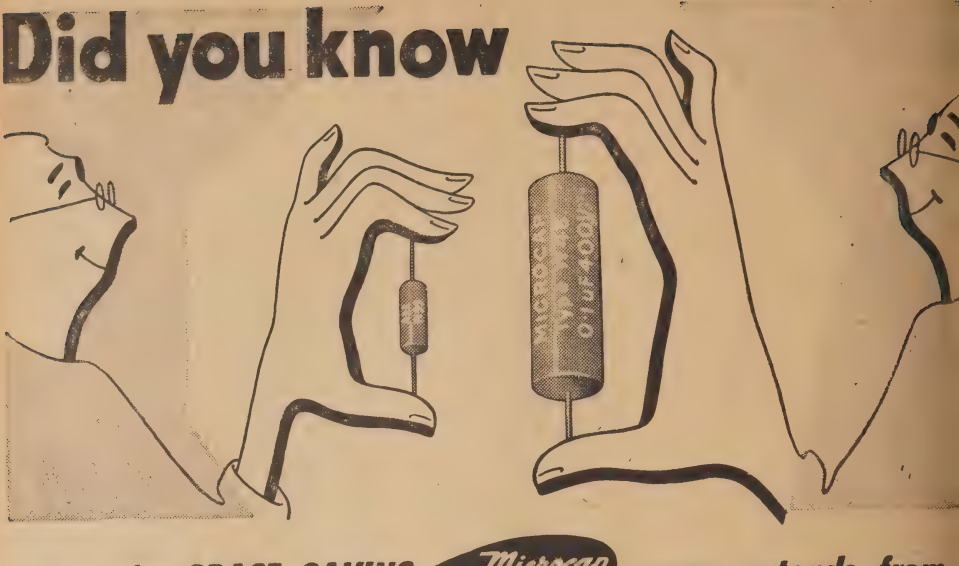
Numerous ideas for this purpose have been developed in the past, and used, particularly in wartime, but all appear to have had disadvantages or an unreliability factor which so far has not recommended them into general use.

At the Institution of Electrical Engineers recently some details were given of the system which has been worked out at Bedford in the last few years.

An aircraft lateral position on a runway is determined by a pair of cables running the length of it and carrying a current big enough to generate a sensible magnetic field.

Height is determined by means of a radio-altimeter, and both these measurements, when properly fed back into a black box full of electronics, are apparently sufficient to make it possible to dispense with human pilots.

Did you know



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NEWS AND VIEWS OF THE MONTH

ative weight

EW international race going on ehind the scientific scenes of , Russia and America may yield stance that falls upwards. ent discoveries in nuclear research e that the existence of such a sub- is not as impossible as it sounds. first nation to produce it will certainly win the race into space, material which overcomes gravity overcome the biggest problem rocket designers.

ntists have named the new re- field "electro-gravitics" or ar gravitics."

e ancient times scientists have aware of the laws of gravitation mutual attraction of masses to- each other.

no one has ever been able to n why it works.

research work in nuclear physics ing the splitting of atoms has l sufficient intriguing facts to con- some scientists that they may be ot only to control gravity, but to e it.

ir discoveries have suddenly nt antigravity materials from the of science fiction to the reality arms race—just as earth satellites to be a joke when Sputnik I went rom Russia.

line of research into the problem s up the field theory of relativity Einstein was working on when he

theory linked gravity closely with and time. Now other scientists amining the theory.

y hope that by transposing space-time values, they may produce new values of gravity.

In this fantastic search, success would mean a material with negative weight.

It could mean a spaceship which would leave the earth without so much as a child's cracker under it.

★ ★ ★

Hotter than the sun

BRITAIN is to build a bigger and better Zeta at Harwell.

The thermo-nuclear energy unit will be one of the hottest fires in the universe—six times hotter than the centre of the sun.

Hundreds of scientists under 41-year-old Dr Peter Thonemann will start work on the project within a few months.

It will take three or four years to build Zeta II and cost between £5 million and £10 million.

When finished it will have a temperature of 100 million deg. centrigade, 20 times hotter than that achieved in Zeta I, though the method will be the same.

Deuterium (heavy hydrogen) taken from sea water is heated to these fantastic temperatures by powerful electric currents.

Then while giant magnets force the hot gases away from the walls of the machine (which would otherwise melt) a release of thermonuclear energy takes hope that they will get an energy "bonus."

In Zeta I they had to put in more than they got out.

It may be possible to tap this energy as electric current instead of heat to drive turbines.

If that happens, Harwell will have to built the prototype of the ultimate powerhouse.

★ ★ ★

Atomic lamp

ANOTHER Harwell development is an atomic lamp—a light powered entirely by radio-activity.

The lamp is expected to shine for at least 10 years without attention.

It is lined with sensitive "phosphor"—the type of material used for lining fluorescent light tubes—and is filled with a radioactive gas.

Atomic lamps made so far are not as bright as electric lights, but scientists believe they can increase the brightness by at least 10 times.

The lamps can be made safe to handle.

★ ★ ★

Alcohol as fuel

THE Philippine Armed Forces Research and Development Division has developed a process to run Army jeeps and light motor vehicles on alcohol instead of petrol.

The Philippine Department of National Defence reports invention of a gadget which, when attached to a vehicle's carburettor, can convert alcohol into a first-class motor fuel.

Production on a large scale is already being planned.

Colonel Florencio Medina, chief of the Armed Forces' Research and Development Division, said the gadget is

POPULAR SCIENCE QUIZ

Q.—Is it true that you can ght an ordinary gas flame with piece of hot chalk?

A.—Yes, it is, if the chalk is hot ough. The point of the state- ent is that all gasses have a flash int, if they are inflammable, at nich combustion will commence. ot until the gas, or enough of it, heated above this point, will it rn.

In most cases, ignition of gas as e know it is started by means of flame—generally a lighted match. But it is possible to heat some bstances to a temperature higher an that reached by a match flame, d quite high enough to exceed e flash point of coal gas.

If we apply the substance, suitably lated, to the gas, it will light just it did from the match flame, for th are able to heat it higher than flash point.

Because of its nature, chalk can heated to a very high temper- e and still stay in one piece. It is, in fact, a High school experiment to heat a piece white-hot in a bunsen flame, and then to use it as a match to demonstrate the point.

Q.—Why are the tones of some musical instruments sharper than others?

A.—The general nature of instrumental sound, or any other sound for that matter, depends upon the manner in which it is produced.

By sharper tones it is assumed that the presence of higher order harmonics is meant, as against smoother tones which are composed largely of fundamentals.

The sharpest musical sounds are probably those made by the oboe, and by the woodwind group of instruments in general. This is because they use vibrating reeds to generate their initial sounds.

A characteristic of a reed is that, in vibrating, the flow of air is completely cut off once during each cycle.

As a result of this sudden stopping and starting of the air flow, steep-sided waveforms are produced which are therefore rich in harmonics. The oboe, which has the lightest reed, and a double one at that, has a much higher proportion of harmonics in its output than it has fundamental.

Brass instruments follow this same general pattern, in this case the player's lips operating as do the reeds.

The nature of the instrument's body has a further effect on shaping the eventual waveform of the emitted sound.

Q.—Why is the moon larger on the horizon than when high in the sky?

A.—It isn't. It certainly seems to be, but the effect is purely an optical illusion.

When near the horizon, we have a handy means of comparing it in size with other objects, whereas in the sky, with its vast expanse, it just looks smaller.

CIRCUIT PROBLEMS ?

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Part 1. Valve characteristics and testing.
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VC1.5I

ed in the engine's carburettor and
tates "atomisation" of the liquid
ol before it reaches the car-
tor.
ch would cost about 10/ Austra-

e of alcohol will ensure continued
lity of troops and material in the
of an emergency where the
ry is cut off from its sources of
l.

★ ★ ★

m power in 10 years

OMIC power stations would not be
uilt in New South Wales for 10
at least, according to Mr Conde,
ricity Commission Chairman for
V.
equate supplies of relatively cheap
coal were available for the com-
on's thermal stations.
added: "I cannot see where we
ave a nuclear station for at least
ars.
probably will be longer.
remendous advances have been
in the field of commercial power
atomic energy.
it it is still an expensive business.
ermal stations, too, are improving
e time."
ntually, this type of power would

★ ★ ★

lersea missile

E U.S. Navy has fired a model of
f its Polaris ballistic missile from
p-up" launcher under the sea.
director of the Polaris program,
Admiral W. F. Raborn, said the
ful launching took place in the
off California on March 23.
said it was a "distinct milestone"
e development of the hydrogen
-carrying missile, which will be
d by atomic submarines.
refused to reveal what made the
launcher "pop up."
wever, he said a submarine was not
in the test.
Navy also revealed yesterday that
ew anti-submarine missile, the
c, could be fired from a submerged
rine into the air to hit another
rged submarine 25 to 50 miles

★ ★ ★

stick for car

ERAL MOTORS CORPORA-
TION has announced the develop-
of a four-inch steering stick, top-
a heavy knob, for steering, brak-
d accelerating a car.
experimental device, at the right
driver's knee, eliminates the con-
nal steering wheel and pedals.
designed to make highway travel

ing the knobbed stick to left or
steers the car in the same direc-

orward thrust accelerates the car,
backward motion applies the

levice called "unicontrol" elimin-
he traditional mechanical linkage
n steering gear and front wheels.
conventional item in the new
control system is an automatic
ission lever on the stub of a
from the dashboard.

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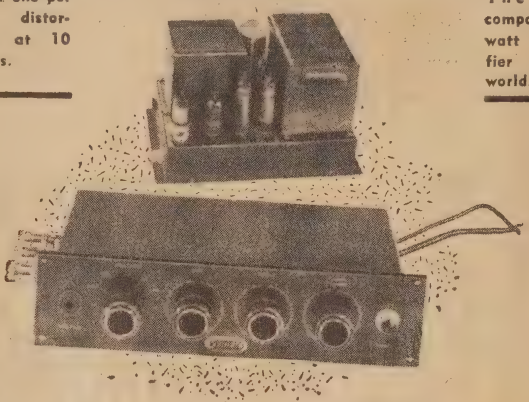

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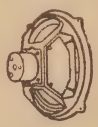
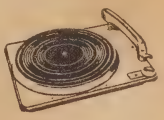


Wharfedale super 12in FSAL speakers.

Barker Duode loudspeakers.



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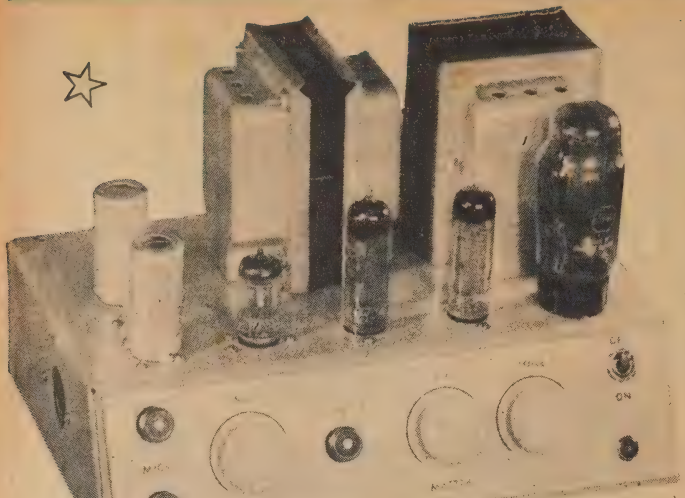


A general view of our new amplifier. controls from left to right are, two m phone input connectors, the microp channel volume control, the pickup i connector, the pickup volume control the master volume control, the tone cor and the on-off switch and indicator b

A 17-Watt Amplifier For P.A. Work

Here is a companion amplifier for the high powered unit described in the last two issues Using an identical component layout, it is lighter, less expensive and has a nominal outpu rating of 17 watts. Coupled to the mixer unit described last month, it will do many of th jobs of its bigger brother at lower initial cost.

HOW much power is required from a PA system? The answer to this will vary in direct ratio to the requirements of the individual, for there are few fields in which the end use is likely to differ so much from one case to another.

These differences are not merely a question of audio output, either, for with big amplifiers capable of producing plenty of sound goes extra size and weight, often a most important matter for the man who had to manhandle the gear in the field.

The result is that we often see PA amplifiers as low as 5 watts, which are extremely portable, but which are likely to run out of steam very quickly when the going is tough. On the other hand, there are plenty of occasions when it would be quite silly to use a big one for a modest need, and which could conceivably wreck a loudspeaker if accidently turned up too high.

Rationalising the position, it is possible to make quite a good case for three basic types of PA amplifiers.

The first would be the small type referred to above in which low weight, enough output for one or two speakers, and simple facilities will be all that is required.

The second type would be of about 15 watts output, much more accommodating in the number of points to be served, but not excessive in size or weight. This type is likely to need more elaborate input facilities than the smaller design, and, in many cases, could well be supplied with a good selection of multiple inputs.

The third class embraces the really big amplifiers of about 35 watts or even higher. It is intended to cope with anything short of a setup so big that special sound systems are called for. These may not be economical or practicable to build for anyone but a sound specialist and a competent one, at that.

by

Wes Yashin

The decision as to which amplifie use must be taken bearing in mind maximum coverage estimated for type, and this includes both indoor outdoor work.

Simple indoor jobs are often se quite well by the small amplifiers. T are frequently used as permanent in lations in small halls and even ou doors where a restricted area, such one requiring a small call system is be covered.

OUTDOOR WORK

For outdoor work, where the ence is more scattered and which likely to be noisier in its creation background, the 15-watt rating is li to be a wise investment. It is quite tonishing how the open air can soak the sound, even when careful spe placement has made sure of intelli sound dispersal over the ground.

In many ways, this type of amp is the safest all-round standby to for it can cover all kinds of pro short of the very big ones, and can be made in compact form.

The components, too, are virtu in the receiving equipment class, an particular problems should arise in viding spares and replacements.

Lastly, in the matter of watts pound, they can be quite attractive a cost basis.

The big group are likely to be in circumstances where special tho has to be given to transport, for stance, in which the amplifier itse a comparatively minor item, when considers such things as speaker f connecting cables, etc. Such jobs rarely covered by a few items w can generally be stowed in the boo the average motor car.

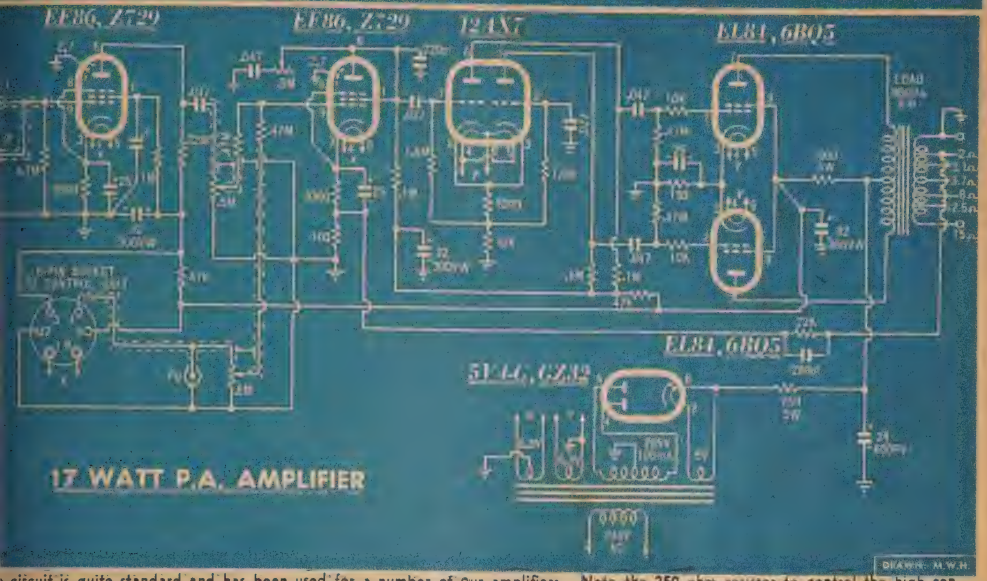
This is the reasoning against we thought it a good idea to restate PA amplifier of last month on a modest scale. At the same time have made it interchangeable as f the control unit is concerned so despite its smaller size, it is capab handling just as many input cha This makes it equal in flexibility, in fact, able to accommodate a any combination of microphone pickup inputs one could imagine.

The nominal output of the am is 17 watts, and allowing for transf losses, we can safely consider th average maximum output of 15 is available.

For voice work, of course, the output of the amplifier would be ciably higher than this.

It should be remembered tha effectiveness of any PA amplif greatly affected by the type of s

THE CIRCUIT DIAGRAM OF 17-WATT PA AMPLIFIER



circuit is quite standard and has been used for a number of our amplifiers. Note the 250 ohm resistor to control the high tension voltage. An output transformer with secondary impedances to suit voice coils is shown, however, an identical unit with normal line impedance; can be used.

which it is used.
th ordinary cone types more care is
d than with horn or flare loaded
ers, with special thought to micro-
e type and placement to avoid feed-

e extra efficiency of the horn type
ers will mean higher acoustic out-
or the same output wattage — so
so that the smaller output ampli-
o used might outperform the larger
l using conventional speakers.

H EFFICIENCY

ese preliminary remarks will not be
to the man schooled in PA work,
ıe will have been through the mill
be fully conscious of them. It is
ably safe to say that most of the
ss achieved in PA work lies in the
ıer in which it is used, and by no
s entirely on the characteristics of
mplifier.
ıd now for some details of the
ɔment to be described.
e reproduction quality of a PA
ifier need not be as high as that
specialised domestic listening nor
the hum level have to be quite as
It is pointless to spend money
ıg near-perfection when the ovarall
rmance will be limited, anyway, by
ɔphones and speakers of average
ty.
is means that we do not need to
arge amounts of feedback, for in-
e, or super-smoothing circuits. Nor
the output transformer need to be
to high fidelity standards.
e circuit, therefore, is quite similar
ındard types used in the past, and
ɔstantially similar to that of the 35-
amplifier featured last month.
e inputs provided consist of two
ɔhone and one pickup channels with
g facilities. Should more be re-
d, the mixer unit described last month may be used, and its connection is made in a similar manner to that specified for it.

Power for the mixer unit may be taken from an output socket mounted on the side of the chassis. A connection in parallel with the pickup input channel is also made through this socket. The pickup volume control thus becomes the master fader, while the existing mic. channel is still available via the existing mixing circuit.

A simple top-cut control in the plate circuit of the second EF86 has been provided and, although it is in the feedback loop, the constants chosen give an adequate degree of control. A control of this type is useful in taming some records and voices, and to aid against acoustic feedback in critical situations.

A simple mixing network in the grid circuit of the second EF86 uses two volume controls and two isolating resistors, one section connecting to the pickup input and the other to the output of the mic. pre-amplifier.

The output transformer shown has multiple taps to suit a variety of voice coils. A voice coil transformer was used because it was the most readily available at the time. A line transformer may be substituted by those wishing to run long leads without loss, or for multiple speaker installations in

PARTS LIST

Parts List (17 watt PA amplifier)—
1 Chassis with sloping front (see text)
1 Power transformer 285/285V, 100mA.
1 Output transformer 8000 ohms P-P, secondary to suit requirements.
1 SPST toggle switch.
2 Octal sockets.
1 6-pin socket.
3 Noval sockets.
2 Noval sockets with shields.
3 Single contact mic. chassis and cable connectors.

VALVES
1 5V4, 2 EL84, 1 12AX7, 2 EF86.

CAPACITORS
3 32 mfd 350 volt electrolytics.
3 25 mfd 40 volt electrolytics.
1 24 mfd 600 volt electrolytic.
1 .1 mfd 400 volt paper.
4 .047 mfd 400 volt paper.
2 .022 mfd 400 volt paper.
1 220 pf mica or ceramic.
1 280 pf mica or ceramic.

RESISTORS.
1 4.7 meg ½ watt.
4 .47 meg ½ watt.
2 1.5 meg ½ watt.
1 22K ½ watt.
3 10K ½ watt.
1 3900 ohms ½ watt.
1 3300 ohms ½ watt.
1 100 ohms ½ watt.
1 1 meg 1 watt.
1 .22 meg 1 watt.
3 .1 meg 1 watt.
2 47K 1 watt.
1 1000 ohms 5 watts.
1 130 ohms 3 watt.
1 250 ohms 5 watt.
3 .5 meg potentiometers.

SUNDRIES.
3 8 lug terminal strips, 1 6 lug terminal strips, 2 5 lug terminal strips, 1 7 lug screw terminal strip, 1 3 lug terminal strip, 2 2 lug terminal strips, 3 knobs, 1 bezel and lamp holder, length of co-axial cable, hookup wire, tinned copper wire, spaghetti sleeving, solder, nuts and bolts, solder lugs etc.

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A cut-out circuit, patented in many countries, automatically protects the instrument against overloads which might otherwise damage the meter or its associated circuits.

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Accuracy: 1.5% FSD on DC, 2.5% FSD on AC.
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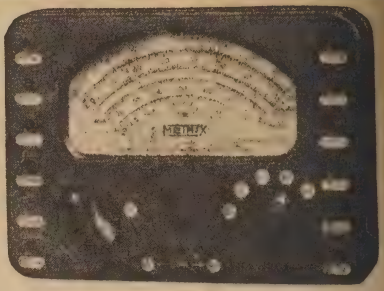

The 28 ranges of the multimeter 460 cover all basic measurements in radio and other low current work. Its small size, the 3¾" easy reading scale, its ruggedness and its accuracy of 1.5 per cent on DC ranges and 2.5 per cent on AC ranges fit it as well for work in laboratories and workshops as for portable use. It is set in a finely finished moulded plastic case and is delivered complete with test leads fitted with probes. Ohmmeter fitted with two international sized batteries accessible without opening the instrument.

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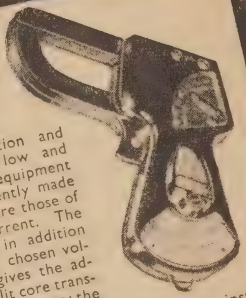

For the installation and maintenance of low and medium power equipment the most frequently made measurements are those of voltage and current. The transclip 400, in addition to its carefully chosen voltage ranges, gives the advantages of split core transformer type ammeters; the measurement of currents without breaking circuit. The shape of the instrument and the arrangement of its different parts have been designed to give maximum ease of use. All manipulations may be made with one hand only.

Technical Characteristics:
AC Current: 10 - 30 - 100 - 300 amps.
Accuracy: ± 5% FSD. Jaws open 1 inch.
AC volts: 150 - 300 - 600, accuracy ±3% FSD.
Sensitivity: 2,000 ohms per volt.

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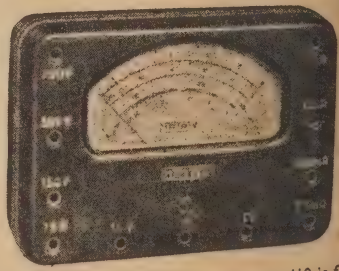
ELECTRICIAN'S MULTIMETER Type 410



Principally designed for industrial use the 410 is fit with a moving iron meter whose accuracy is good this type of instrument. The small size of this m meter and its mechanical ruggedness make it an work-mate for all electricians. Small moulded

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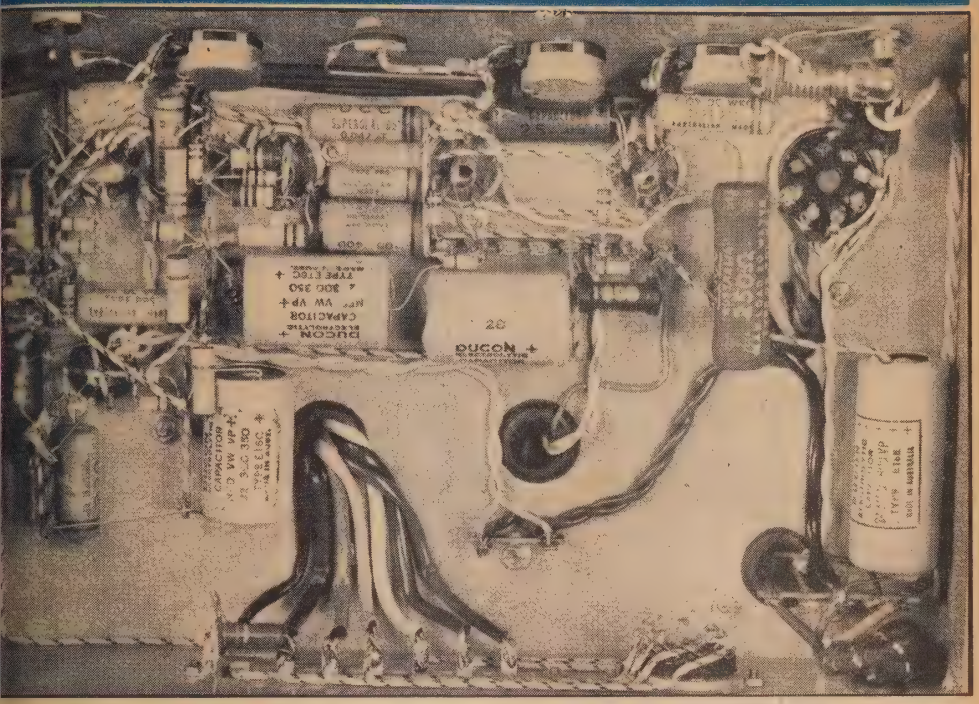
UNDERCHASSIS OF THE 17-WATT PA AMPLIFIER



This under-chassis photograph clearly shows the minor component layout and should be of assistance when wiring.

a higher output impedance is more
e.
ti-tap transformers are available
umber of makes, and all of them
be suitable in this circuit. In
se the taps were at 2, 3.1, 3.7, 8,
nd 15 ohms, but all these may not
essary.
ative feedback is obtained from
ohm tapping on the transformer
ary. The constants selected were
s to give a 12 db gain reduction,
ing adequate to provide low out-
pedance and useful reduction of
on, yet not great enough to in-
instability problems as a result
varying loads likely to be pre-
to the amplifier.

BACK

n a lesser degree of feedback
be quite practicable, but it would
wise to use more than the speci-
nount.
lback is taken from the low im-
e tap because this arrangement of-
vo advantages—a more constant
ck characteristic with varying load
ons, since the feedback is always
from a loaded portion of the sec-
, and a precaution against unwant-
se rotation which lessens the risk
ability.
phase correction capacitor was
l for best performance on a
wave test. However, if a differ-
ke of output transformer is used
be necessary to alter the value
capacitor.
he stability margin of the ampli-
quite good, the value as given

could be regarded as a safe value in the absence of a direct check. The capacitor could, in fact, be omitted altogether.

The power transformer is rated at 285 volts, 100 mA, and should deliver about 350 volts at the rectifier cathode. Since this exceeds the maximum ratings for the output valves, we found it necessary to introduce a dropping resistor between the rectifier cathode and the first filter capacitor. The value of resistance was chosen to give just on 300 volts on the plates, measured to the cathode.

A directly heated rectifier could probably have been used without the need to reduce the high tension with a dropping resistor.

In this case, higher ratings would have been necessary during the warm-up period, and the extra cost of suitable components, and their comparative scarcity, may easily have outweighed the saving on the rectifier valve and the resistor. If this is no problem to you, then a 5Y3 would probably produce near enough to optimum voltages in a straight circuit.

The filter network is quite simple, and, by avoiding the use of a filter choke, we save on the cost and weight. The output plates are fed from the first filter capacitor since the pushpull circuit eliminates most of the hum due to ripple. The screens and the earlier stages are supplied through a simple decoupling network which is quite effective by reason of the small current drain.

The transformer rating of 100 mA should be adequate even if a tuner is used. However, the low tension current drain will have to be watched and it may be necessary to parallel the heater windings to even out the current drain.

The chassis layout is almost identical with last month's version and could well become a standard in amplifier layouts. A smaller chassis is used, and measures 11 x 6¼ inches across the top and 11 x 7¾ inches across the bottom, the difference being due to the sloping front. The depth of the chassis is 2¾ inches.

The under-chassis photograph gives a good idea of the minor component layout and should be of assistance when wiring the amplifier. Tag strips are used to support many of the components and leads, the remaining components being suspended from point to point by their pigtails.

Looking over the rear edge of the chassis, the mic. pre-amplified socket is on the lower left side, with the gap in its pins almost facing the lower left corner.

STRIP SUPPORTS

A six-lug strip to the left of this socket supports the bias resistor for this stage as well as its bypass. It also provides anchor points for the grid leak, the screen bypass and the shielded lead from the grid to the parallel input connectors.

To the right, a five-lug strip supports the plate load, the screen dropping resistor, the decoupling resistor and its bypass electrolytic.

Directly above the mic. pre-amplifier valve socket is the second EF86 valve socket. The gap in its pins faces in the

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WESTON MODEL	RANGE	TYPE	DIA. FLANGE	DIA. BARREL	PRICE
S20	100 UA	Moving Coil	3½"	2⅝"	£8 12 6
S20	200 UA	DC	"	"	6 17 6
S20	1 MA	"	"	"	5 15 0
S26	1 MA	"	"	"	"
S20	5 MA	"	"	"	5 5 0
S26	10 MA	"	"	"	5 0 0
S26	15 MA	"	"	"	"
S20	20 MA	"	"	"	"
S20	50 MA	"	"	"	"
S20	100 MA	"	"	"	"
S20	500 MA	"	"	"	"
S20	1 AMP	"	"	"	"
S20	2 AMPS	"	"	"	"
S20	3 AMPS	"	"	"	"
S20	10 AMPS	"	"	"	"
S20	20 AMPS	"	"	"	"
S20	50 AMPS	"	"	"	"
S20	1 volt	"	"	"	"
S20	3 volts	"	"	"	"
S20	5 volts	"	"	"	"
S26	10 volts	"	"	"	"
S26	15 volts	"	"	"	"
S26	20 volts	"	"	"	"
S26	30 volts	"	"	"	"
S26	50 volts	"	"	"	"
S26	80 volts	"	"	"	"
S26	100 volts	"	"	"	"
S20	0-3 volts	Cell Testing Voltmeter	"	"	5 12 6
S22	10 MA	Thermo-couple	"	"	11 0 0
S22	50 MA	AC	"	"	"
S22	500 MA	"	"	"	6 0 0
S22	1 AMP	"	"	"	
S22	2 AMPS	"	"	"	"
S22	5 AMPS	"	"	"	"
S22	10 AMPS	"	"	"	"
S21	1 MA	Rectifier (AC)		"	"
					6 15 0
S33	10 AMPS	Moving Coil	2 3/16"	2 3/32"	4 5 0
S33	50-0-50 AMPS	DC	"	"	"
S50	10 MA	Moving Iron	3½"	2⅝"	6 5 0
S50	20 MA	AC/DC	"	"	6 0 0
S50	50 MA	"	"	"	
S50	100 MA	"	"	"	"
S50	250 MA	"	"	"	"
S50	1 AMP	"	"	"	"
S38	Volume Unit Meter	Rectifier	4¼"	3 9/16"	12 10 0

W.F. METERS

Ruggedly constructed to give lifetime service

MODEL	RANGE	TYPE	DIA. FLANGE	DIA. BARREL	PR
4in Flush	160 Volts	Moving Iron AC/DC	6"	5"	8
4in Flush	300 Volts	" "	6"	5"	8
4in Flush	5 Amps	" "	6"	5"	7
4in Flush	10 Amps	" "	6"	5"	
4in Flush	20 Amps	" "	6"	5"	
4in Flush	50 Amps	" "	6"	5"	
4in Flush	100 Amps	" "	6"	5"	
5" Projecting Pattern	5 Amps	" "	8"	7"	8
6" "	10 Amps	" "	8"	7"	
6" "	20 Amps	" "	8"	7"	
6" "	30 Amps	" "	8"	7"	
6" "	50 Amps	" "	8"	7"	
6" "	80 Amps	" "	8"	7"	8
6" "	100 Amps	" "	8"	7"	8
6" "	150 Amps	" "	8"	7"	9
6" "	200 Amps	" "	8"	7"	9
6" "	300 Amps	" "	8"	7"	9
6" Flush	5 Amps	" "	7¾"	6 9/16"	8

"SANGAMO" model S.7 SYNCHRONOUS MOTOR UNIT

Available in speeds from 3,600 revs per hour to 1 rev in 7

SANGAMO Automatic TIME SWIT

An automatic memory for opening and closing electric circ specific, pre-set times.

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Gives accurate control over any machinery operation up working period of 170 minutes. Manual switch on; automatic off.

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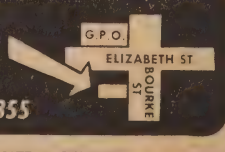

TRADE AL SUPPLIE

OPEN SA MORNING

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ie direction as that of the preceding
ve. An 8-lug strip to the left sup
ts the bias resistor with its bypass,
two isolating resistors in the mixer
work with their respective leads, the
ohm resistor at the earthy end of
bias resistor and the lead to the feed-
k components, one end of the coup-
capacitor from the previous stage,
the plate bypass capacitor.
second 8-lug strip to the right sup-
ts the plate load for this stage, as
l as the decoupling resistor to this
ge and one end of its bypass. The
e loads, the grid leaks and the re-
ors in the cathode circuit of the phase
nger are also anchored to points on
strip.
he phase changer socket is the next
line from the EF86 socket and the
in its pins faces the output valves
ch follow. The gap in the pins of
first output valve socket faces al-
st directly to the rear edge of the
ssis while that of the second is a
e to the left.

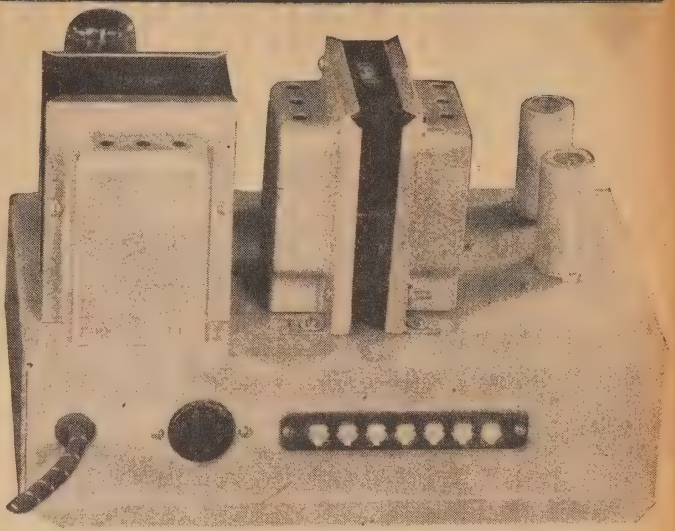
RID STOPPERS

n 8-lug strip below the output valve
kets is retained by the socket mount-
bolts. This strip supports the grid
s, the grid stoppers and the respec-
ends of the coupling capacitors from
phase changer. The screen decoup-
resistor and its bypass are also
hored to points on this strip.
hree more tag strips are used; a
g strip to support the high tension
pping resistor and the filter capaci-
a 5-lug strip in the lower right cor-
to support the incoming AC leads,
transformer primary leads and the
s to the switch. A three-lug strip
as an anchor point for the low ten-
supply leads to the earlier stage.
he output transformer secondary
s are once again terminated at a 7-
strip equipped with screw terminals
mounted on the rear edge of the
ssis. The feedback resistor and phas-
capacitor are anchored between the
supporting the 2-ohm tapping and a
g strip from which a lead goes to
8-lug strip previously mentioned.
n octal socket is wired in parallel
the screw terminal strip and pro-
s an alternative means of connecting
he speaker system.
he remainder of the wiring is quite
ightforward provided certain precau-
s are observed. A common earth

Note on 35 Watt P.A. Amplifier

or our 35 watt P.A. amplifier, de-
ed in the preceding two issues, a
-volt power transformer was speci-
with the suggestion that, if the D.C.
ut voltage proved too high, it should
reduced to about 360 by including
itable resistor in the H.T. secondary
re-tap lead.
ubsequent collaboration with local
sformer manufacturers has allowed
ew standard transformer to be evolv-
with a secondary rating of 305 volts
side and this, in conjunction with a
4 rectifier, will give the required DC
ut voltage without additional drop-
resistance.
ransformers released for use with
amplifier will accordingly carry
new rating and we suggest that, to
d possible future confusion, you
e a note of it against the circuit in
March and April issues.
ote also that the 2200-ohm bias re-
r in the 12AX7 cathode can be re-
d to advantage to 1000 ohms.

REAR VIEW OF THE AMPLIFIER



A rear view of the completed amplifier, stressing its simplicity and showing the method of terminating the output transformer secondary tappings.

point for each of the voltage amplifier stages is essential, if hum due to earth loops is to be avoided. The input connectors must be insulated from the chassis and connected to their respective earth points near the relevant valve sockets.

As a wise precaution, connect the remaining earth points with a common run of heavy tinned copper wire, to guard against poor contact with the chassis in the future, due to rust or corrosion.

A further critical piece of wiring involves the two .47 meg. insolating resistors in the grid circuit of the second stage. These must be mounted as close to the grid pin as possible, with no more than about half an inch or so of attaching lead.

The shielding braid on the leads from the input circuits to the relevant valve sockets and tag strips should be earthed at the common earth point near the valve socket, only. The earthy ends of the potentiometers and the input connectors are returned to earth through this braid. Coaxial cable was used in place of the usual shielded hookup wire as it is insulated and not likely to cause shorts when coming into contact with the rest of the wiring and components.

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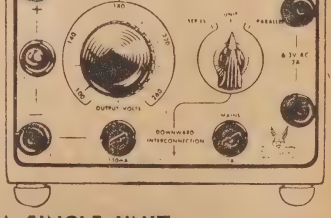
An idealised variable voltage 'B' Battery.

Developed by the C.S.I.R.O. and manufactured by the Fairey Aviation Co. of Australasia Pty. Ltd., these stablized power supply units can be quickly fitted together in a vertical stack to provide increased voltage or current capacity, or to give several different output levels convenient in the development of electronic circuitry.



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Voltage range	100-260 volts.	Impedance	0.1 ohm.
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PL 10

UESTIONS AND ANSWERS ON TV

Q.: What causes hum in the sound of television set? In my receiver, the n level is just enough to be annoy-. Extra filter capacitors do not seem help.

A.: Hum in a television set can be due the same causes as in any other re-ver or amplifier. Inadequate filtering one of them; heater-cathode leakage nother, as also are unwise earth re-ns for the audio input wiring; these y introduce hum from eddy currents he chassis.

t is much more likely, however, that hum is actually a 50-cycle buzz due interaction between the station's nd carrier and the frame frequency its picture carrier. The suggestion ld be confirmed if the hum is only ent when stations are being received particularly, if the hum level varies tly with different scenes.

ince all such picture information is ent as an amplitude modulation, it upposed to be rejected by the sound ter stage in the sound IF amplifier also by the ratio detector. Norm-it is rejected, leaving only the inal frequency modulated sound to heard through the loudspeaker.

lowever, if the limiter stages are not king properly or not peaked perly, some of the unwanted ampli-e modulated picture information may through. Actually, it should be re-ed by the ratio detector but, again, may be slightly off in its adjust-t.

Ve may have something to say about ning sound IF channels in our next e and this may assist you, if you e the facilities to tackle the job. If it looks like a job for your service-n.

ver and above faulty alignment, ex-ive input signals may produce over-l and intermodulation of sound and ure in an IF stage to such a degree the sound channel cannot wholly ct the AM content. A pad in the al lead-in or a less elaborate aerial egin with, may help in such a case.

urning the aerial away from the ction of the station will also weaken als but this may introduce other bles in the way of picture "ghosts."

.: I have built my own television iver, which is performing very well. here any objection to building it into arge high-fidelity speaker cabinet of type which is sometimes pictured in rseas magazines?

.: Yes, there is one distinct objec-to the idea, which may or may not mportant. The cores in coils and IF sformers are seldom capable of g locked in position and can, in e cases, wind themselves down the ad if subjected to prolonged vibra-

here can be a good deal of vibra-in a large speaker enclosure, par-larly when the system is being used ot for television—but to play record-at loud volume. We have heard of ouple of cases where the vibration been sufficient to upset the TV re-er alignment over a period of some ks.

Ve can only suggest that if you are ning to associate a TV receiver in any way with a large loudspeaker enclosure, you try to protect the chassis from vibration as far as possible and see that the cores are held firm with one of the commercial core locking greases.

Q.: I have a commercial receiver of well-known brand. Ever since a recent electrical storm, the pictures on the screen have been poorer in quality and one station suffers with ghosts. What could possibly cause this?

A.: It would seem from what you say that something has happened to the aerial signal input circuit of the receiver.

The fact that it was an "electrical" storm may be of no consequence, the aerial or lead-in having suffered damage from wind. We suggest you examine it carefully to make sure that connections are tight or that nothing has been broken.

If the aerial appears to be in order, there is a chance that a mild lightning strike (if there is such a thing) has damaged the aerial input circuit in the tuner. We have heard of one case where this apparently happened, with symptoms not unlike those you describe.

Q.: The younger members of my family complain at times about a high-pitched whistle from our television set. They say it is worse some times than others and also varies in pitch. Could this be so?

A.: The whistle would be sound energy from the line output transformer or the deflection yoke at the line frequency of 15,625 cps. Young folk are more conscious of it than their elders because their ears are normally more sensitive to extremely high frequency sounds.

The sound intensity may possibly vary with temperature and expansion effects which allow the offending materials to vibrate more readily on some occasions than on others.

However, ears which are subject to a constant whistle for lengthy periods tend to develop a temporary "hole" in the response, so that the whistle may not be noticed quite so much after a period of viewing. Again, the exact position of the head will affect the loudness.

The change in pitch would occur when the set is being tuned. With no input signal, the line oscillator normally runs at a slightly lower frequency.

Q.: I notice that there is a difference between the line oscillators in your 17 and 21in receivers. Which is the better one?

The two circuits are basically the same in their operation and both are perfectly satisfactory as far as performance is concerned.

Electrically the circuit in the 17in receiver is slightly the more simple of the two, since it uses slightly fewer parts. However, the idea of winding a core through many turns for "Line Hold" is not the best mechanically and we modified the circuit slightly to allow this function to be taken over by a potentiometer.

The circuit otherwise remains the same and it is simply a choice between saving the last few pence or having a mechanically robust control.

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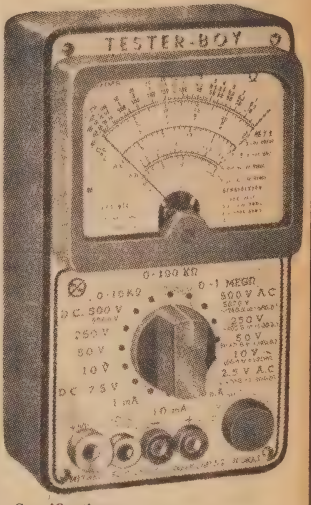

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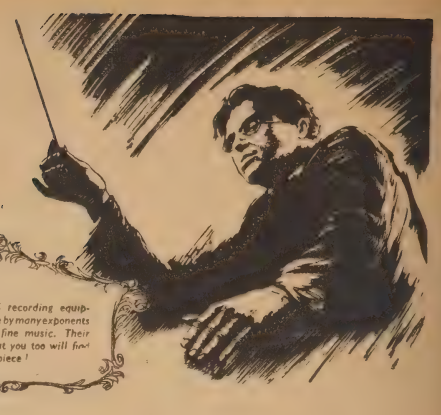

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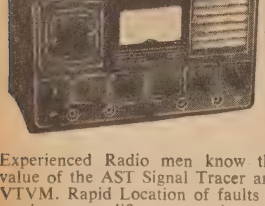

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Service Organisations and servicemen are welcome to try the instrument which interests them in their own workshop for one week, free of charge. You are thus able to test the instrument under conditions peculiar to your service requirements. No obligation to purchase, just a service we expect to give.

- Literature available on all instruments. A.W.A., Paton, etc.
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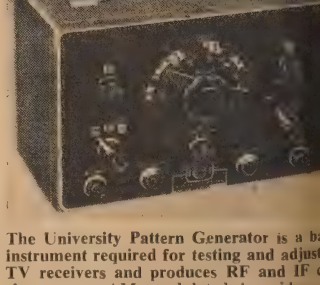

The University Pattern Generator is a b instrument required for testing and adjust TV receivers and produces RF and IF rier waves, AM modulated by video nals to produce horizontal or vertical or a pattern of horizontal bars and vert rows of dots. These patterns enable vert and horizontal linearity, height, width, tering and focus adjustments to be car out. These adjustments, even when a sta is on the air, are not readily carried due to unsuitable programme mater Number of bars in vertical and horizo patterns are variable as well as the num of dots, by means of controls on the fr panel. This instrument is attractive tec cally in its advanced features and physic in size and appearance. Price of TVR. £60. Plus tax 12½ per cent.

Preset Radio Clocks. Able to set switch switch off time. Ideal for tape recorder displays, radios, etc. £6 complete.

FROM THE SERVICEMAN WHO TELLS

he line output stage is probably one of the most complicated sections of a TV receiver and, hen something goes wrong, the symptoms are likely to appear almost anywhere, and in any form. Often they may seem to be quite unrelated to the true cause.

wever, before discussing technical rs, I should like to comment a more on some of the closing ks I made last month, par- rly as these brought forth favourable comments from set facturers. One such comment, the head of a service department ging to one of our large manufac- , is typical:

n glad you raised this point," he concerning my statement that cases nsatisfactory service are best re- l to the manufacturer), "because seem to be comparatively few e who realise that we—along with other manufacturers—have a very equipped service department and nly too happy to service our own

ER JOB

nd, quite frankly," he added, "we often do a better job, at a lower than the average independent ser- an; particularly where the fault is usual one, or where the set appears giving more than its fair share of le.

ne last thing we want is a dissatis- ustomer. If a customer is unhappy the performance of a set, and the is unable to correct this state of s, then we welcome the opportunity t things right. And," he added, are not in the least interested in ner the set is paid for or not."

of which is a very reassuring con- tion of what I said last month, and pts me to enlarge on some of these s.

st, the question of approaching the facturer when other means of ob- g satisfaction fail. While it is pro- true that many people do not e that manufacturers have their service organisations, I think it is rue that a proportion of those who ware of these facilities, hesitate to nem for other reasons.

IDENCE

major one of these seems to be a n diffidence on the part of cus- rs to approach a large organisation what they fear may be treated as a l complaint. They imagine that their ular tale of woe will be merely e voice crying in the wilderness. ernatively, they imagine that ser- work carried out by the makers is to prove much more expensive that provided by the local dealer, a few eccentric types firmly be- that they will never see their own s again.

ll, I can't speak for all such service tments of course, but I have spent sonable part of my career in such s and I am quite confident that fears are groundless.

particular, the "voice in the wilder- idea is quite wrong. I have known a single letter, not necessarily well written or carrying any business heading, to turn a whole department into uproar, particularly where there is any suggestion that the writer has not received the service to which he is justly entitled.

In particular, I remember a letter which was finally directed to the head of a wiring department. It was from a dealer as it happened, but that made little difference. It listed a number of faults which had been found in a batch of new sets, including a dry joint and a number of minor mechanical troubles.

Considering the effect it had, a stranger would have been pardoned for imagining that the sets had gone out half-wired, and minus the valves and speaker. The boss called together the wirers, assemblers, inspectors, testers, cabinet fitters, and final testers and, with

a deceptive quietness, read them the letter.

Then his voice rose half an octave and several Db as he proceeded to "dress them down" in a manner that would have done credit to any sergeant major. When the crews finally returned to their benches and test booths, they were in no doubt as to their responsibilities.

And all because of one letter.

While it would be wrong to imagine that scenes like this happen every time a complaining letter is received, it does emphasise that such letters are certainly not ignored. On the contrary, they can have a marked influence on the design of a set and the running of a factory.

Similarly, a customer who approaches the service department with a faulty set and a complaint that the dealer seems unable to fix it is not likely to be ignored, either. On the contrary, the set will probably receive a more thorough "going over" than ever it would at the hands of the most conscientious serviceman, and not be allowed to leave the department until it behaves in every respect like a new set.

WON'T BE BEATEN

What is more, it is unlikely that any tricky fault will ever beat an organisation like this. It is usually well equipped with test gear, with access to additional equipment in other parts of the factory. The personnel service nothing but these sets, invariably "know them backwards," and take a pride in pouncing on faults peculiar to them. In addition, they have available an almost unlimited supply of spare parts to substitute for a suspected faulty one.

Finally, when a really tough fault is encountered, there is invariably a fully equipped laboratory and team of engineers to fall back on. Such a situation would be rare but I have known it to happen.

Nor is the cost of all this likely to be prohibitive. A thorough knowledge of the set means quick and efficient handling, plus the fact that such a department would not be expected to make a large profit. In fact, if it did no more than break even most firms would consider that the goodwill it produced would more than compensate for the lack of a tangible profit.

SERVICEMAN'S PLACE

And where does the dealer-cum-serviceman fit into this picture? Am I suggesting that the independent serviceman (including myself) should lock up his shop and take a job on the local garbage cart?

Not by a long shot. He has a very definite place in the scheme of things, and this might be as good a time as any to consider just what it is. First of all, a good dealer would never allow the situation to arise, whereby a customer was forced to seek the aid of the set manufacturer. He would have sought such aid himself much earlier, immediately it became apparent that the fault —or faults—were unusual, or that the customer was becoming impatient.

(In the event that the set was still within the free service period—and the dealer had accepted responsibility for that service—he would still have to meet whatever charges the factory made. However, since he would not have expended his own service time on the job, such charges would be largely offset.)

As far as the ordinary everyday routine faults are concerned, the local

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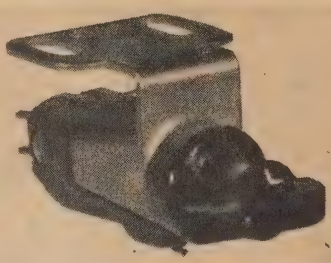

* Extremely high compliance enabling good tracking and low record wear
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General Specifications for Ladder Networks

CONSTRUCTION.—The main body of the Attenuator is of one-piece moulded Bakelite with 28 non-tarnish solid silver studs and a non-tarnish silver wiper ring integrally moulded.

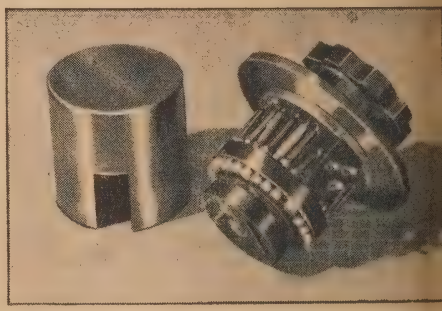
NOISE LEVEL.—Does not exceed 5 micro-volts per volt input.

RESISTORS.—Unifilar wound on moulded Bakelite flat bobbins with the highest grade of resistance wire giving low thermal coefficient and excellent frequency characteristics. All resistors are aged and fully tropic proofed. When carbon resistors are used only the best obtainable are employed.

RANGE.—0.39db — variable in steps of 1.5db tapered to infinity on last stud. Anti-clockwise rotation for increase of attenuation.

SIZE.—Depth 1⅜in, Diam. 1¾in.

IMPEDANCE.—50, 200, 600, 10,000, 100K or 470K ohms.



Types UF and UP

ACCURACY.—All wire wound resistors are adjusted to within 1% on DC.

INSULATION RESISTANCE.—Greater than 1000 Megohms.

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viceman is the logical person to do
job. No one could justify sending
et back to the makers merely to
rect a faulty rectifier, dried-out elec-
ytic, open circuit audio screen resis-
or the dozens of similar faults which
stitute 90 per cent of service calls.
he mere convenience of the local
p is enough to justify its existence,
a serviceman with average skill
uld be able to handle all ordinary
s on a profitable basis and at a
onable cost to his customers.
ut is it reasonable to expect any
serviceman to know all the tricks
peculiarities of all radio and TV sets
the market—now and in the future?

E "CURLY ONE"

for one, do not believe it is. Which
ns that, sooner or later, the said
rage serviceman is going to find him-
up against a "curly one." In such
s he has two courses open to him.
may "flog" the problem until he
er solves it by sheer tenacity and
e forcé (or gives up in despair), or
may admit defeat early and call on
eone else for assistance.
he first course may be a laudable one
ar as one's ego is concerned, but is
always the most practical. Most of
vill crack a problem if we stick at it
enough, but at what cost in time?
do we charge the customer for
time—and probably lose him forever
do we carry it ourselves and risk
often?
he second course may seem like
itting failure, but is really no dis-
e. If, by passing an obvious "bomb"
rticularly a new set—back to the
ers, we save our own time and the
omer's money, surely it is the logical
g to do. And if, in addition, we
v the maker's attention to faults
ch should never have occurred, we
performing a double service.

good dealer, therefore, is one who
ws, almost instinctively, when a set
be handled profitably and economi-
by his own department, or when
far better returned to the maker.
his way he keeps his service depart-
t running smoothly, does not have
load" his prices to take care of too
y sticky jobs, and creates a higher
r of customer satisfaction.

nother matter I touched on last
ith was the question of time payment
us cash, and the effect on subsequent
ice to the customer. I imagine my
had hardly reached the editor before
as tackled once again on the same
ect—and by no less a person than
of my own in-laws.

FERRED TERMS

hinking ahead to the time when she
ld buy a TV set, the dear lady made
profound statement that she intended
uy on terms (even though she could
rd to pay cash) because of the better
ee this provided.
resh from writing last month's article
afraid I laid it on pretty thick regard-
the fallacy of this assumption, as well
ointing out the financial advantages
aying cash when this is possible.
it seemed I was getting nowhere.
lady was adamant, and I knew better
to argue with one of the opposite
—and an in-law to boot!
owever, a few days ago word reached
by a round-about route to the effect
the lady was, in fact, having second
ghts on the matter, even if she wasn't
ared to come right out and admit
it. So perhaps my eloquence wasn't wasted after all.

Coming to matters technical, I have a most interesting case concerning the line output stage of a TV set. The "moral"—if there is one—would seem to be the degree to which the numerous functions of this stage are inter-related, quite critically in some cases.

The story started when a very old customer (i.e., a customer of long standing, not an octogenarian) approached me for some advice regarding his own set. He has a smattering of things electronic, so he was at least able to give an intelligent description of the symptoms which were worrying him.

"Tell me," he asked, "what causes a white line down the centre of the picture?"

We were unable to photograph the actual picture fault, but here is an artist impression based on our description and instructions. It gives an excellent idea of the effect observed. The white line is much brighter than normally observed in genuine over-drive cases.

WHITE LINE

My immediate reply was to suggest it was a sign of overdrive to the grid of the line output stage, but went on to explain that the order of drive, once set, does not normally shift. This naturally prompted me to ask whether it had always been present or when he had first noticed it.

"That's a bit hard to say," he replied. "You see, it is only there during the first five or ten minutes after the set warms up, after which it fades out. And quite frankly," he added, "I seldom have the job of switching it on. The kids turn it on around five o'clock before I get home, and it runs until we go to bed.

"Last weekend was the first time I had turned it on for some weeks, and it was only then that I noticed it. When I mentioned the effect, the kids said, 'Aw yes, it's been like that for some time.' And that's all I know about it."

I had to admit that, off hand, the effect was rather puzzling and suggested it would be best if I had a look at the set as soon as possible. The owner was quite agreeable, but suggested I leave it for a week or so, as he was going on holidays, and I could work on it without rushing while he was away.

"Oh, and there's another thing," he added, as he was about to leave, "there seems to be some kind of intermittent fault as well. The picture width seems to jump from one size to another on occasions and it also affects the white line if it should happen to be present."

All things considered, I was rather glad he was not in a hurry for it.

A week later I collected the set and found a place for the chassis in a corner of the work bench. I had decided to let it run for a few days, in the hope that the intermittent would show itself in a manner which I could identify. With a little luck, I might save myself a few headaches.

When first switched on the picture showed a classic overdrive line, exactly as described by the owner. I watched it carefully, and after five minutes or so I realised it was not nearly as obvious as it had been. In fact, it was only just discernible, and after another few minutes it had vanished.

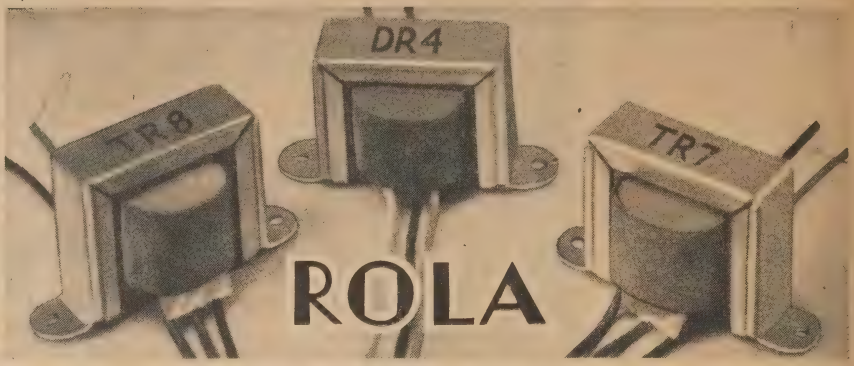
LINE O/P VALVE?

Thinking the problem over, I considered the possibility of the line output valve being sick. If this were so, it seemed likely that the valve's limited emission and inability to respond to peaks of driving voltage would mean that it was, in effect, being overdriven, even though the actual driving voltage had not increased.

Of course the EHT voltage should be down, but this need not show immediately in terms of picture quality. There is normally such a reserve of brightness that we can afford to lose something before it becomes apparent.

Similarly, the horizontal deflection should be less, except that the reduced EHT will largely offset this, by reason of the lower beam velocity and easier deflection. It could make the picture overscan vertically but, knowing my customer, I had no doubt that he would have corrected any such condition.

If it were a borderline case, this con-



ROLA

TRANSISTOR TRANSFORMERS

Suitable for use in the "Radio, Television and Hobbies"

"TRANSISTORISED INTERCOM AMPLIFIER"

These transformers have been designed in the Rola Laboratories specially to meet the requirements of Australian radio set manufacturers for highly efficient driver and output units which provide a good frequency response when used with standard type low-powered transistors.

They are intended to operate into a standard 3.5 ohm impedance loudspeaker voice coil. General specifications of the output types TR7 and TR8 are similar, but a greater signal input is required to get the increased power for which type TR8 is rated.

ROLA TRANSISTOR TRANSFORMER SPECIFICATIONS

TYPE	DESCRIPTION	IMPEDANCE OHMS	OUTPUT POWER 6 v.	9 v.
DR4	Driver transformer	3,000 - 1,300 c.t.		
TR7	Output transformer	420 c.t. - 3.5	150 mW	250 mW
TR8	Output transformer	300 c.t. - 3.5	200 mW	375 mW

HIGH EFFICIENCY LOUDSPEAKERS

Two small high efficiency Rola loudspeakers intended for transistor or conventional battery-operated receivers have also been developed.

The first of these is the new Model 4C-05A fitted with an F44 diaphragm. This speaker is small in size — it measures only 4⅛" overall by 1¾" deep, light in weight — only 6¾ oz. (without transformer), yet has an efficiency equal to that of the earlier Model 4F. Its low cost, small dimensions and light weight make the 4C-05A an ideal choice for miniaturised battery or transistor receivers.

Where even higher efficiency is required and space and weight are not critical, it is recommended that the Model 5F be used.

ROLA COMPANY (AUST.) PTY. LTD.

n would be worst when the valve came into operation and before it its surroundings were really hot. r about 10 minutes the temperature he entire EHT cage would have appreciably, allowing the cathode erature to rise and a few more rons to be liberated into the stream. hile all this was pure speculation, I not keen at this stage to disturb set unduly, in the hope that I could a better lead on the intermittent, h also had to be reckoned with. So, r than fiddle with it halfheartedly, nply let it play until I was ready to le it properly.

fact I had observed the intermit- effect once or twice already, and it exactly as the owner had described But, apart from confirming that it happen, my observations had not very helpful thus far.

ne next important development was r startling, and happened a few days . I switched the set on for the first that day and was surprised to find the picture lacked brightness. The lition was quite serious, the picture g woefully dark, even in a reason- darkened workshop.

TRAP MAGET

or no particular reason, I reached be- the tube and moved the ion trap net a fraction. The picture immedi- brightened, and careful adjustment uced a perfectly adequate picture. nen I did a spot of head scratching. ne set had been normal the day be- what had happened to it over- t? How could the ion trap shift of wn accord? Or had it shifted, or some other effect necessitated its re- stment? At the moment there seem- no answer.

few hours later I had occasion to k to an engineer friend from one of valve companies and I took the op- unity to inquire whether the strength n ion trap magnet could vary while ervice. He replied that this could pen, but that it would be a rather condition. So that was that.

efore I had been able to speculate much on other possibilities the set matters into its own hands. When itched it on the next morning the iance had dropped again, and this no amount of fiddling with the ion would restore it.

decided that the time had come to to grips with the thing, intermittent o intermittent.

he first thing I did was check the T voltage. This turned out to be only V, which was quite a few kV lower it should have been. Then, on an alse, I checked the mains voltage. vas also low, but not in quite the e proportion.

y now a theory was beginning to n in my mind. Could the need to st the ion trap magnet have been to low EHT voltage? If so it might easonable to assume that the EHT age, already on the low side if the output value was weak, had fallen further due to a mains voltage drop he previous day.

SSIBLE STORY

his had caused a drop in brilliance two reasons. Partly because of the t effect of low EHT, and partly be- e the tube's operating conditions no er suited the placement of the ion . Presumably, the present drop in voltage was even worse, and nothing d be done about it.

If all this were true, then a new line output valve would probably restore the EHT sufficiently to render it immune to such mains voltage variation. However, it was likely that I would have to adjust the ion trap again.

I opened the cage and commenced to remove the valve, which turned out to be a 6BQ6. I didn't get very far, for as I removed the plate connection, the plate cap came away with it. What was more, a detailed examination of the lead-through wire revealed that no portion of it had even a suspicion of solder on it. It was a typical dry joint.

This was a rather gratifying discovery. It could easily be the cause of the intermittent—considering all the symptoms—and it could just as easily be the cause of the valve failure. Any power valve running on reduced plate voltage will almost certainly suffer from excessive screen dissipation, since more electrons will now be attracted to the screen, and the screen current will rise.

ALTERNATIVE VALVE

(Remember the old 59s? They couldn't tolerate an open plate for more than a second without becoming gassy.)

The next thing was to replace the valve. The only snag was, I didn't have a 6BQ6 on the shelf. The nearest I had was a 6DQ6, but I could see no reason why this could not be used, at least temporarily. It is a similar valve, has the same base connections, and more liberal dissipation ratings.

I plugged it in and switched on. As the set warmed up everything came good. The brightness was really high, there was no sign of the white line, and even the ion trap seemed to be in the right place. More prolonged observation suggested that the intermittent was also cured. The only fault was reduced picture height, an effect I fully anticipated, and this was quickly corrected.

I was rather puzzled about the ion trap. I moved it back and forth again, but its present position seemed as good as any. In fact, I realised that it did not seem to be nearly as critical as it had been previously.

Subsequent inquiries directed to the valve engineer I mentioned previously, confirmed this suspicion; an ion trap becomes extremely critical when the tube is operating on reduced EHT voltage. Thus a setting selected on normal EHT may not suit a reduced voltage, though a setting selected for a reduced voltage could easily suit the normal voltage.

SUMMARY

In case all this seems a little disjointed and hard to follow it may be as well to summarise the major points. Presumably the 6BQ6 had a dry joint under the plate-cap, which caused variation in voltage applied to the plate, producing the intermittent effect on the picture size.

At the same time, the reduced plate voltage was causing the screen to overheat, liberate gas, and prejudice the operation of the valve. Now the white line appeared, being a sign that the valve was, in effect, being overdriven, while the EHT and the line output both dropped.

These two effects largely bucked each other, though the vertical scan had obviously been adjusted—probably in small amounts—as the EHT voltage slowly fell.

However, the accidental drop in mains voltage was the last straw, reducing the

(Continued on Page 79)

New Instrument Cases Fittings and Chassis

Figured front panels for R. & H. designs. Vacuum Tube Voltmeter, Multimeter, Sweep and Marker Generator, Oscilloscope. These are figured and holes punched, black background, silver figures.

19/6 plus tax 12½%

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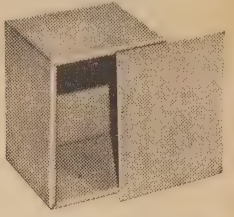

Standard Instrument Cases. Finish Grey.

Cat. No.	Long	High	Deep	Price plus 12½% S.T.
MC6	6	6	6	11 9
MC5	9	6	5	12 10
MC7	10	8	7	17 10
MC67	12	7	6	19 9
MC81	10	10	8	1 3 6
MC811	12	11	8	1 8 3
MC82	13	8	6½	1 8 3
MC79	15	9	7	1 11 0

SLOPING FRONT CASES

SF7	7½	6½	6	15 3
SF79	9½	6½	7½	19 6
SF71	11	6½	7½	1 2 0
SF8	13	8	8½	1 6 6
SF10	18	10	10	2 1 0

R. & H. type Cabinets, finish Grey Hammerdock, louvred sides, welded corners.

			Plus tax 12½%	
MC5A	9	6½	5½	18 9
MC82A	13	8	6½	1 12 3
MC87A	15	10	8	2 2 0

Sloping Front. R. & H. type, Grey Hammerdock finish.

SF7A	7½	7½	7½	1	1	0
SF79A	9½	7½	7½	1	4	6
SF71A	11	7½	7½	1	9	6
SF8A	13	8½	8½	1	11	6
SF10H	18	10	10	2	6	0

Chassis unpunched can be supplied for any of above.

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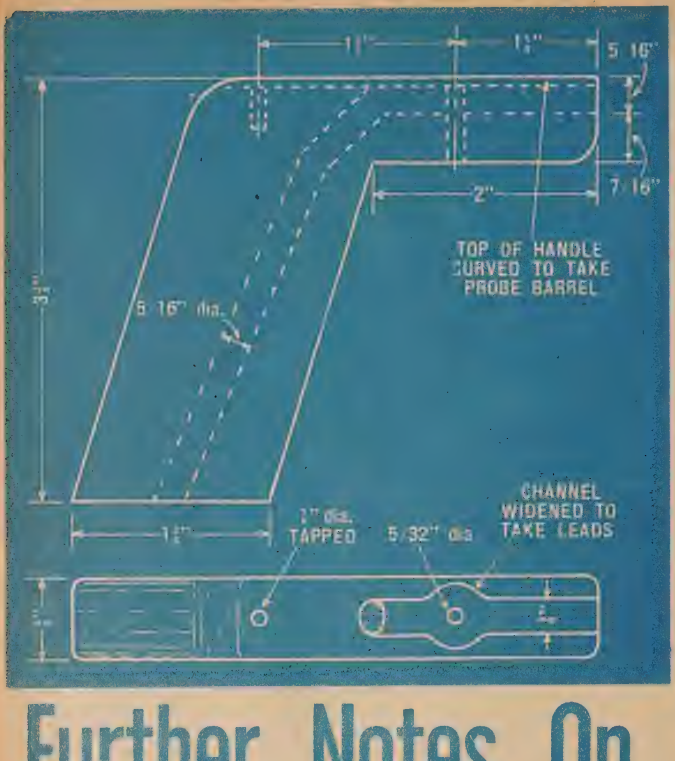


A detailed drawing showing the construction of the pistol grip handle for the probe. A tough, close-grained wood is preferred, and few simple woodworking tools are all that is required to complete the job. Note the hole for the cable entry.

Further Notes On Capacitance Meter

As promised in our original article (February, 1958) we are now able to publish some additional information concerning the Probe Type Capacitance Meter. The meter scale and some additions to the probe are the two main subjects discussed.

by Philip Watson

First the meter scale. Originally, there was no suitable scale available but, having calibrated our own scale against suitable standards, we passed the data on to the manufacturer who supplied the original meter. He readily agreed to print such a scale and to make it available on new meters when requested or as a separate item for those who may already possess a suitable meter

BASIC CALIBRATION

Such a scale will assist materially in solving the problem of calibration, particularly where such facilities are otherwise limited. Naturally, there will be variations between individual instruments, but these should be of a minor order, and reasonable accuracy should be provided by merely adjusting the full scale senstitivity to 50 pf against the best standard available.

When additional standards become available the "law" of the instrument can be checked and, if necessary, adjusted. Slight changes in the ratio between the 2 pf and 100 pf which form the capacitance divider in the input circuit will alter the law, particularly at the low end of the scale. It will also alter the sensitivity, but this can be corrected by means of the 1,000 ohm sensitivity potentiometer.

When making exact measurements, as for calibration against a high quality standard, it is important to realise that the zero setting of the meter is very easily upset, due to stray "C" associated with the active terminal of the pro

For example; if the instrument zeroed and an ordinary push-on alliga clip is then fitted to the probe tip, will be found that the meter will r an appreciable distance up the sc due to the increased capacitance betw the tip and the body of the probe.

Similarly, grasping the body of probe too near the tip end will produce an unwanted meter reading, for the same reason. We will have m to say about this problem later.

USING STANDARDS

For purposes of calibration, we fo the following arrangement best. Lay probe near the edge of the bench w the tip protruding as far beyond it possible, thus placing it clear of rounding objects. Now form one pig of the standard capacitor into a h and hang it on the probe tip. The ot pigtail connects to the earth lead.

It must be emphasised that the n to take these precautions is not in sense an indication of undesirable ch acteristics in the instrument. It is pu the result of the high sensitivity wh it possesses, and which makes it valuable. However, unless the proble associated with this characteristic fully appreciated, wrong readings calibrations can result.

As already mentioned, the manner holding the probe could add sm amounts of stray "C" to the circuit, which could be significant when total amount being measured is sm This, plus another problem, led us consider modifying the physical sh of the probe.

The other problem concerned heat of the probe. We found that, a prolonged use, this could become enough to make it uncomfortable handle. Additional ventilation holes h ed a little, but it was still a border-case.

We finally solved both problems fitting a "pistol grip" handle; at the s time solving the minor problem of rather awkward cable entry we forced to use with the original pr The latter now enters through the ha and is well out of the operator's

NEW FASHION?

All things considered, we feel this idea has much to recommend and may well start a fashion for in ment probes in general. In additio the advantages named above, it is a more convenient and natural way hold what is, after all, often a ra awkward device.

There are doubtless many way which such a handle can be made,

may even be a ready made product
ible somewhere, if only we could
it. In the meantime we simply
ed a scrap of suitable wood, a few
working tools, and produced the
you see in the accompanying pic-
For those who wish to do likewise,
resent a diagram of the essential
isions.

e wood we chose was a scrap of
5in thick cedar which happened to
n hand, though any reasonably
grained timber would do as well.
ict, some of the hardwoods, such
otted gum, would probably be a
deal better if the more difficult
ing is no objection.

BLE ENTRY

ving cut the handle to the general
required, provision must be made
he cable to enter at the bottom
find its way to the front of the
e. First drill a 5/16in hole from
ottom of the handle, at the angle
ated, and almost to the top. Then
the top, drill a second hole to
the first one, but a greater angle
which will help to take the cable
ind the corner."

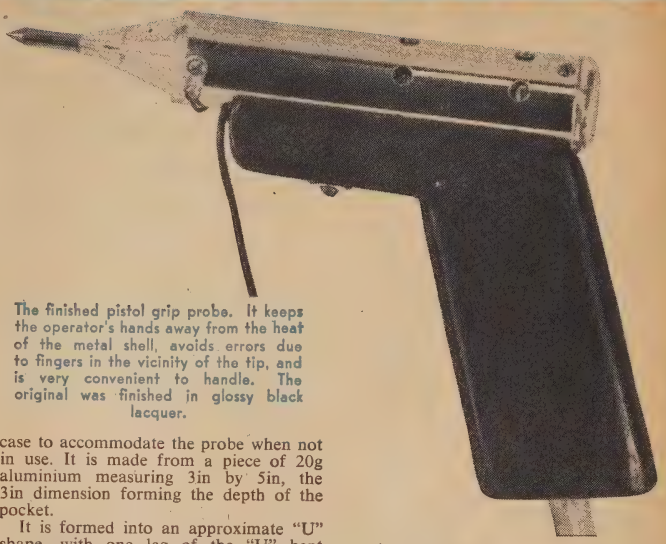
om here the cable is accommodated
channel cut in the horizontal por-
of the handle until it enters the
of the probe. About half way along,
channel is widened somewhat to
the wires to divide and a screw
ss between them and into a tapped
in the probe.

e other mounting point is near the
of the handle, where a screw from
the probe passes into the handle.
latter should be countersunk and
be either a wood screw or a mach-
crew, such as a 1/8in Whitworth.
latter, although not intended for
job, will normally cut a strong
d in suitable timber if the correct
pilot hole is drilled first.
cess to the head of this screw is
ided either by means of one of the
lation holes or a suitable hole speci-
drilled for the purpose.

SEMBLY

he screw which is tapped into the
l must be just long enough to sit
with the inside, otherwise there
risk of it fouling one or other of
components. Select a screw slightly
er than required—allowing for a
er under the head—then use it to
nt the empty barrel on the handle.
surplus thread should be filed away,
a large rat tail or half round file.
assemble the two sections, the
ks" should be fitted to the barrel
ut the valve, this being fitted later
the other end by removing the
l perspex cover. The screw which
into the barrel is fitted first, care
taken to see that the wires in the
nel are not pinched or cut.
en the rear screw is fitted, making
that there is plenty of room for
valve, the valve itself follows and,
y, the perspex cover. To facilitate
val of the valve should the occas-
arise, it is best to arrange one set
entilation holes near the junction
he valve and socket. In this way
ewdriver blade can be inserted to
in easing it out.
nally, we made a metal "pocket"
he right hand side of the bench

DETAILS OF PROBE PISTOL GRIP



The finished pistol grip probe. It keeps the operator's hands away from the heat of the metal shell, avoids errors due to fingers in the vicinity of the tip, and is very convenient to handle. The original was finished in glossy black lacquer.

case to accommodate the probe when not in use. It is made from a piece of 20g aluminium measuring 3in by 5in, the 3in dimension forming the depth of the pocket.

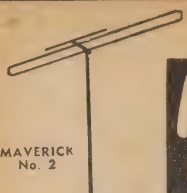
It is formed into an approximate "U" shape, with one leg of the "U" bent outwards at right angles about ½in from the end. The flange so formed mounts against the side of the case, while the end of the longer leg mounts against the back of the case.

Shape the remainder to allow the probe to fit reasonably firmly, but not so tightly that it will jam when you want to remove it. Place it so that the lower end of the probe tip is clear of the bench when the probe is in place.

For really accurate measurements it is best to allow about five minutes "warm-up" period, though, for rough work, it can be used immediately the valves are hot. The 50 pf "standard" brought out to the front panel is well worth while, and gives a clear indication when the condition of stability has been reached. In selecting a capacitor for this application, it must be appreciated that the panel terminal will add at least 3 pf to the total.

A nominal 47 pf (mica or NPO ceramic) which is "spot on" or a little on the low side is ideal, and can be shunted with small amounts of extra "C" is necessray. In our case the best we could obtain was a fraction higher than required, and we reduced the capacitance of the panel terminal by fitting several insulating washers between the panel and the solder lug under the nut. In this way we were able to adjust the final capacitance to a very accurate figure

SAVE ON TV AERIAL ERECTION



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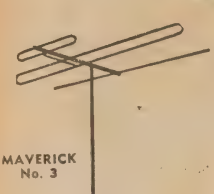

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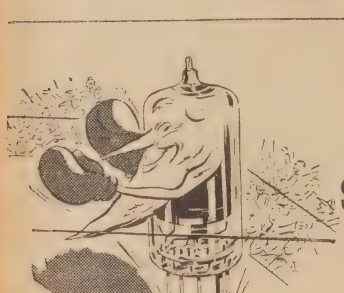

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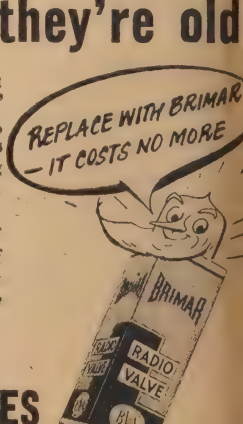

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FUNDAMENTAL TRANSISTOR THEORY

Semi-conductors are becoming so important in electronic work that a knowledge of the theory behind them is essential to radio men. Ufortunately this excellent article, prepared by Delco, is too long for a single issue but it will be concluded next month.

PART 1

A NEW era in electronics is gradually developing. The transistor, discovered in 1948 by Bell Laboratories and named for the two words "transfer resistance," will no doubt significantly influence the design of electronic devices. Although smaller, more rugged, and requiring less operating voltages than the vacuum tube, the transistor in many cases can perform the same functions with better efficiency.

The transistors that are now on the market, and those that will soon be made available, are varied in size and appearance. Some voltage amplifier type transistors will be very small while power gain type transistors will be somewhat larger. Some transistors will be rectangular in shape, some will be the shape of a wafer, and some will be round, fairly flat devices.

The transistor is certainly here to stay; improving many of our existing types of equipment and lending itself to be used in other equipment never before employing electronic devices.

In the automobile, for example, the transistor is ideally suited because it requires only 6 or 12 volts for operation voltages readily available in any car. For this reason, it is not too difficult to visualise many other applications for the transistor in tomorrow's automobile; such as automatic headlight dimming, electronic braking devices, electronic ignition and starting systems for the higher compression engine, and even electronic steering where the driver may be able

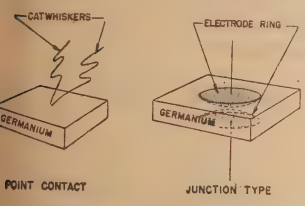

Fig. 2—Types of transistors

to read a book, eat his lunch, play a game of cards, or just converse with friends without worrying about the usual driving of the car.

The compact transistorised automobile television set may someday become almost standard equipment. The portable radio will become even more portable, fitting into the palm of the hand or being worn on a strap as we do a wrist watch.

The application of the transistor in industry where electronic control devices are used may make these devices even more popular than they are today. Due to its high dependability, the transistor will be used in controls for safety, navigation, and many other applications in the world of transportation.

And now, let's compare the transistor with the old faithful vacuum tube which we have known so well and worked with for years.

The transistor will operate with a much lower current drain than the vacuum tube. A great deal of this is due to the fact that the transistor does not have a filament, and as we all know, in most vacuum tubes, the power required to heat the filament is many times more than that power that is realised in the useful, job-doing portion of the tube.

This feature alone is of great value

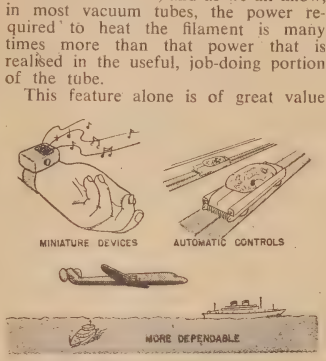

Fig. 1—Transistors have many uses

for use in portable electronic equipment since the battery life will be greatly increased.

Unlike the vacuum tube, the transistor can operate on extremely small voltages. Whereas most vacuum tubes must have a plate supply in the neighbourhood of 250 to 350 volts, the transistor can operate directly from a low voltage battery supply.

Since both the operating voltage and current drain of the transistor are much lower than that of vacuum tubes, it is logical to assume that the battery supply in a transistorised unit can be greatly reduced. Again we can see that this low voltage, low current feature of the transistor will open many more doors to the use of electronics than we have enjoyed in the past.

There are many types of transistors that can be made available; however, up to now, the two most popular types have been the point contact and the junction transistors, Fig. 2.

In this illustration we see the general make-up of a point contact type transistor and we see that it consists of a pellet of germanium upon which two cat-whisker type leads have been fixed.

Fig. 3—Atomic structure

This type transistor was actually the first type developed, but has lost much of its popularity due to manufacturing difficulties. The operation of the point contact type transistor is very dependent on the physical spacing between the two cat-whiskers. This, coupled with the fragility of the cat-whisker contacts, makes it an extremely difficult production problem.

The type of transistor in more common use today is the junction type transistor. As can be seen in Fig. 2, the junction type transistor consists again of three parts, a germanium wafer and two metallic discs. Leads attached to the metallic discs which are diffused into the germanium wafer become electrodes of the transistor.

The junction transistor is far more stable and rugged than either the point contact type transistor or the vacuum tube, and is fast replacing certain vacuum tubes in radio and electronic applications.

STRUCTURE OF THE ATOM

The chief difference between a transistor and a vacuum tube is that the current carries, electrons in a tube, flow through a vacuum but the current carriers (not always electrons) in a transistor must travel through a solid material. Therefore, it will be necessary to examine more closely the physical make-up of germanium and the other types of metal used with it in order to understand how a transistor works.

For many many years, scientists have studied the solar system and for about

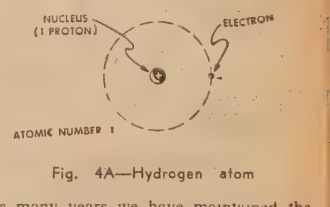

Fig. 4A—Hydrogen atom

as many years we have maintained the theory that the atomic structure of matter is very similar to that of the solar system.

In our solar system the planets revolve about the sun in certain orbits. Of course, no two planets spin around the sun in the same orbit. We can see then that the sun and its planets constitute a family. This same type of family exists in the make-up of matter; we call it an atom.

Since the basic structure of matter is the atom, let's take a look at one of them. Very much like our solar system, an atom is made up of a nucleus around which a certain number of electrons will rotate.

There are certain rules governing the orbits of these electrons in that the first ring away from the nucleus will have a maximum of two electrons travelling in

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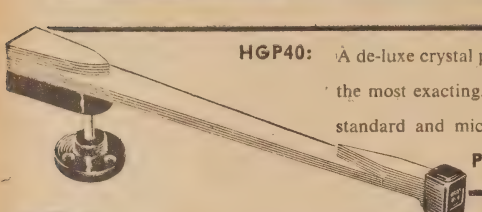

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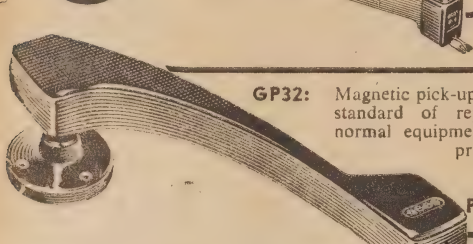

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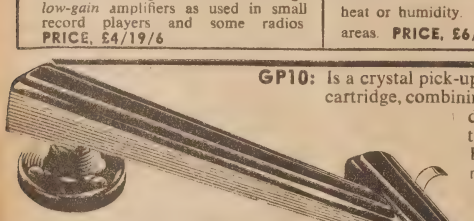

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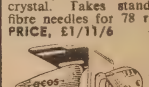

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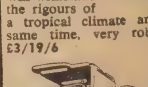

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ring. The next ring or orbit will a maximum of eight electrons. The ring will have a maximum of 18, next will have a maximum of 32, so on.

hen the outer ring or orbit of an contains the maximum number of ons it is a stable material. These on rings are very important in the of electricity, since it is the make- f these rings that determines if an ent will conduct electricity or not. let's consider examples of atoms me of our basic elements.

gure 4a shows an atom of hydrogen h is the simplest form of matter m. You will notice that it has a us with one proton in it and one on travelling around this nucleus he first orbit. The atomic number drogen is one since it has only one ron and one proton.

we all know, hydrogen is a gas is much lighter than air and at one was used extensively for inflating ons. Hydrogen is not stable and bines readily with oxygen making safe for this use, and a switch was to the use of helium in balloons. figure 4b, we see that helium con- of a nucleus and two electrons re- ng around this nucleus. You'll e that both of these electrons are he same ring. Helium is known as ert gas since its outer ring is com- . The atomic number of helium is

he difference between one element another lies in the number of elec- s revolving around the nucleus of atoms of the different elements. An- r basic difference lies in the num- of neutrons, neutral electric charges, lie in the nucleus with the proton. , let's consider the most complex ent, uranium.

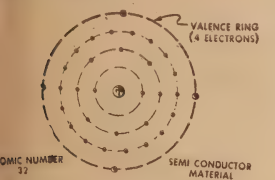

Fig. 7—Germanium atom

he atomic number of uranium is 92. his means that the nucleus of the ium atom will have 92 electrons ing about it in different orbits or s. You'll notice that the first ring two electrons in it, the second ring eight, the third ring 18, the fourth 32, the fifth ring 18, the sixth 12, and the outer ring will have electrons in it.

s we mentioned, this is the most plex of the elements. All the basic ents will have a number of elec- s rotating around its nucleus vary-

Fig. 4B—Helium atom

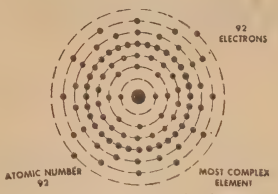

Fig 4C—Uranium atom

ing from the hydrogen atom having one electron to the uranium atom which has 92 electrons.

We have now talked about the basic structure of matter, so now let's take a look at this structure from the standpoint of conduction of electrical energy.

The ability of an element to conduct electricity is dependent upon the number of electrons in the outer ring of an atom of that element. Any of the two

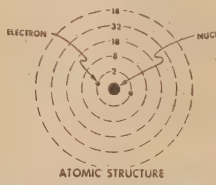

Fig. 5—The nucleus

outer rings can be incomplete since the numbers indicated are the maximum number of electrons that will be found in that ring. All outer rings are considered complete if there are eight electrons present there.

Elements which have a nearly complete outer ring will not readily conduct electricity. These outer ring electrons of a nearly completed ring are held more tightly to the nucleus than those of an element where the outer ring is less complete. In an atom of an element which has only one, two or three electrons in its outer ring, these electrons are not tightly bound to the nucleus.

In these atoms, the outer ring electron can be moved from one atom to another, by means of the application of a difference of potential. In conduction, we are primarily interested in the metallic elements such as iron, copper, silver, aluminium, etc. Each of these elements are considered conductors because their outer ring has only one, two or three electrons in it.

Any element that has five, six, or seven electrons in its outer ring will not be a conductor of electricity and is referred to as an insulator. It takes a tremendous difference of potential applied to this material to cause the electrons to be broken from the outer rings and constitute current flow.

Considering Figure 6a, we can analyse an atom of a good conductor. You will notice that in the outer ring of this atom, there is only one electron. That electron is held to the nucleus very loosely and the application of a difference of potential will force this electron away from that outer ring from where it will travel to the next atom.

This movement of electrons from atom to atom gives us current flow.

In the atom of an insulator shown in Figure 6b, the electrons in the outer ring of this atom are more tightly held to the nucleus because the number of electrons in this outer ring approach that of eight which can be considered the number of electrons required to complete an outer ring. No elements will be found with more than eight electrons in its outer ring.

Since these outer ring electrons are held tightly to the nucleus, it is easy to see that the difference of potential that must be applied to move these electrons is much greater than that of a conductor. For that reason, we call this an insulator. Of course, all insulators will conduct electricity if a high enough voltage pressure is applied to it.

SEMI-CONDUCTORS

In Figure 7, we see a representation of an atom of germanium. The atomic number of germanium is 32; this means that it will have four electron rings of two, eight, 18, and four respectively.

Germanium has the unique properties that under certain circumstances, it will be a conductor, but not a good one; and under other conditions, it will be an insulator. At the lower temperatures, germanium is an insulator, and at the higher temperatures, germanium acts somewhat like a conductor. For this reason, germanium is known as a semi-conductor.

Germanium is one of those elements that because it has only four electrons

CONDUCTOR

INSULATOR

Left—Fig. 6A: Three or less electrons in the outer or valence ring.
Right—Fig. 6B: Five or more electrons in the outer or valence ring.

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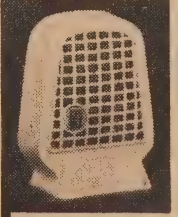
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its outer ring, has an affinity for com-
nation with other atoms whose outer
ngs are also incomplete. The outer
ng of an atom is called its valence
ng. If a number of atoms of ger-
anium were to join together into a
ystalline form, we have what we call
)-valent bonding.

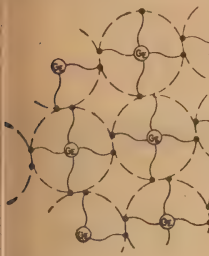

Fig. 8—Crystalline germanium (co-valent bonding).

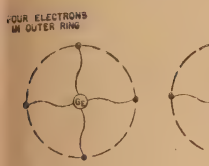

Fig. 9—Germanium (left) and antimony (right).

In crystalline germanium, the valence lectrons or outer ring electrons of each tom will combine with electrons in the uter ring of adjacent atoms and with ne two valence rings of the atoms oined, forms co-valent bonding. If we ook at the nucleus of one of the ger-anium atoms, we see that instead of aving four electrons in the outer ring, now has effectively eight. With each tom having exactly eight valence elec-rons, instead of the original four, this onding of electrons makes the material very good insulator.

PREPARING THE GERMANIUM

In Figure 9, we see an atom of ger-anium and an atom of antimony. You ill notice that for simplification rea-ons, it shows only the nucleus and the uter or valence rings of each atom. As e have seen before, the valence ring f the germanium atom has four elec-rons in it. The outer ring of the anti-ony atom has five electrons.

If we add a very minute amount of ntimony to crystalline germanium, we nd that the antimony atoms will dis-ribute themselves throughout the struc-ure of the germanium crystal. Let's onsider what takes place in this ger-anium crystal.

In Figure 10, we are looking at an rea of the germanium crystal where an tom of antimony is located. Note that he antimony atom, with its five valence lectrons, has gone into co-valent bond-g with its germanium neighbours, but doing so, has one electron left over.

In other words, the antimony atom ill form complete co-valent bonding ith the germanium atoms but for each ntimony atom present, we will have an xcess of one electron in the material hich does not enter into co-valent onding. Thus, each antimony atom in the material donates a free electron, and multiplied by millions of antimony atoms, enough electrons are obtained to support current flow through the material.

The antimony is called a donor since it donates free electrons, and the germanium crystal now becomes N-type germanium (negative type) because of the presence of these electron current carriers.

It must be pointed out that the antimony impurities are added in extremely controlled amounts, because if the number of conduction electrons becomes too great, the material then becomes simply a good conductor. Other factors which would increase the number of conductor electrons beyond the usable range are moisture and heat sufficiently high to cause electrons to leave their bond. Later it will be shown what methods are taken to protect a crystal against these factors as much as possible.

We have now established a germanium crystal which has some conduction electrons dispersed throughout it. Since these electrons have a negative charge, we can now call this material N-type material or donor material.

Now we will compare the indium atom to the germanium atom. As we know, the germanium has four valence electrons in its outer ring. The indium atom has only three electrons in its outer ring. Here again, indium is another element that will enter into co-valent bonding with germanium, in which case, the outer ring electron of each atom will be shared by the outer ring electrons of a neighbouring atom. Let's see what takes place when a controlled amount of indium impurity is added to a germanium crystal.

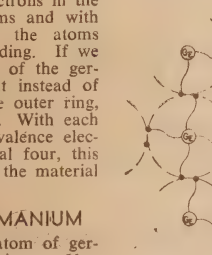

Fig. 10—Donor N-Type germanium (negative current-carriers).

The atoms of indium will distribute themselves throughout the crystalline structure of the germanium.

Since the indium atom has only three valence electrons compared to germanium's four, co-valent bonding will occur between the two atoms. However, for every indium atom in the material, we will have a deficiency of one electron that is needed to complete co-valent bonding between the two elements.

Since this atom or combination of atoms will have an affinity for an electron to complete its co-valent binding, we can say that we now have a hole. In other words, a hole can be defined as a deficiency or a lack of an electron, and represents a minute positive charge.

You can easily see that this type of material will readily accept an electron to complete its co-valent bonding and we therefore can call it acceptor material. Since the hole will be the cur-

(Continued on Page 105)

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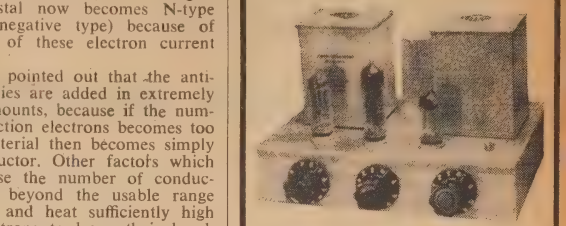

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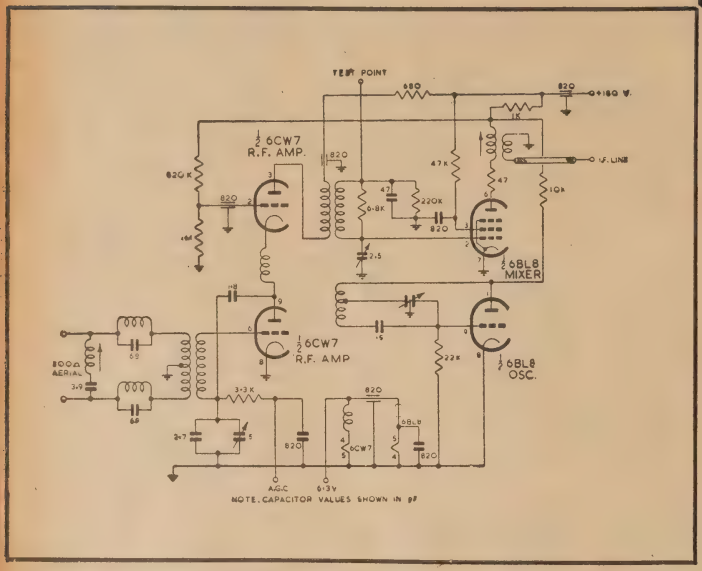

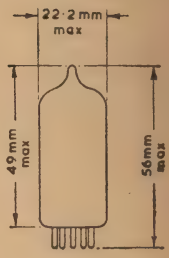

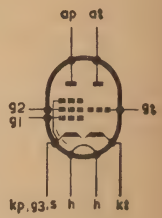

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V_{g_2}	—	200V
I_a	14.0mA	7.0mA
V_g	— 2.0V	— 3.2V
g_m	5.0mA/V	5.5mA/V
u	20	$g_1 - g_2$ 47
r_a	4.0 Kohms	900 Kohms

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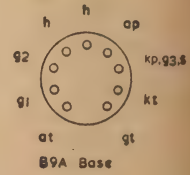

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All About Audio and Hi-Fi

—Transients and Directional Effects

By G. A. BRIGGS
Managing Director
Wharfdale Wireless Works

PART 7—Speaker mounting has a pronounced effect on transient response, and in this article an analysis is made of several popular mounting methods. Some suggestions are also given for the avoidance of high-frequency beaming, about which the writer has definite ideas.

AT the end of the previous article the effect of shock treatment on various speaker units was illustrated, but as a high-impedance source of about 6 ohms was used, the results showed more "ringing" than would occur under normal conditions of use where the high damping factor of the amplifier plays a not insignificant part.

The following tests show the effect of different methods of mounting a 10in speaker, 10-15 ohm type, with the source impedance reduced to 15 ohms to give a damping factor of about one-to-one.

OPEN BAFFLE

With open baffle mounting and a good magnet it will be seen from Fig. 6A that ringing has been virtually eliminated, in spite of the large initial displacement of the voice coil.

A comparison of this curve with the others (B, C, D, and E) confirms the contention that you cannot put a speaker unit in a cabinet or on a horn without making it sound like it, because it affects the natural movement of the cone.

The cleanest results are obviously obtained from the open baffle, but nature is again perverse and limits our bass output by the size of the baffle.

If we counteract this by increasing the bass input by 6 db per octave we tend to overload the unit, hence the development of so many resonant enclosures and folded horns. But a couple of speakers in parallel on a baffle give a 3 db gain at low frequencies, and double the power handling capacity, and various methods of damping to avoid excessive cone movement and distortion, without boxing in, are possible.

It would be difficult to give a complete technical explanation of the results as shown in Fig. 6, but the following points strike me as significant.

The reflex enclosure (B) reduces cone movement but increases power handling capacity. The corner model (C) weighs 44 pounds and shows signs of panel resonance, which can be heard in the program material. The huge and heavy exponential horn (D) is probably better than any folded horn but, surprisingly, still shows signs of metal ringing which is faintly audible on program.

The brick enclosure (E) shows a clean line and lowest resonance of the lot but is followed by slight traces of enclosure resonance, again faintly audible on program.

The circuit used for the tests is given in Fig. 4. A scope with a driven sweep is used. R1 gives control of the input voltage (E1) and R2 enables the DC voltage across the oscilloscope terminals to be balanced out and so avoid the false transient due to the AC coupling of the scope input circuit.

Poor transient response is not entirely due to insufficient voice-coil damping. We are still left with the serious problem of low damped resonances in the cone itself and in the enclosure (if one is used) which are so loosely coupled to the driving system that electromagnetic damping is impossible.

The effect of these resonances is to produce ringing and hangover at the various frequencies concerned and this, in turn, is manifest as coloration of speech and music.

Cone breakup usually results in a rise in output in a region above 1 kc., but before this is condemned out of hand a word of warning should be given.

Many reflex enclosures boost the bass by resonance, but mask the upper register, and therefore require a speaker unit with strong output in the treble for a reasonably balanced performance. A "perfect" speaker unit with flat response would sound awful used alone in such a cabinet.

Various techniques have been devised for studying transient decay behavior using chopped tone and pulse excitation, but none of these methods has proved completely successful.

WHITE NOISE TEST

The best tests to date are probably subjective ones employing white noise and male speech, as the coloration imparted to these sounds is quite distinctive on the A-B test.

With experience, it is possible to locate roughly the trouble region by listening carefully to white noise. Panel resonance can be exposed by banging a cabinet with a hammer or even the fist; the general pitch of the sound so produced with flimsy enclosures is easily heard as coloration on white noise. Unfortunately white noise cannot be used as a complete guide until somebody produces the perfect speaker as a 100 per cent reference point, so that we

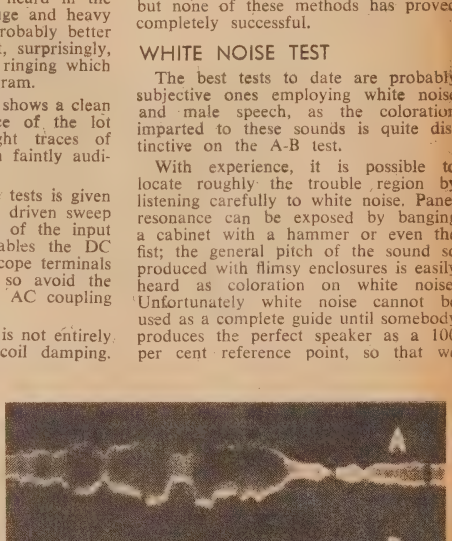


Fig. 1. Effect of 7in x 1in slot diffuser on 8in wall-mounted speaker. Mike is 18in on axis in open air. (A) shows the response without and (B) with diffuser.

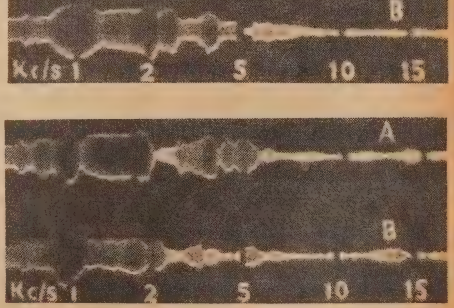
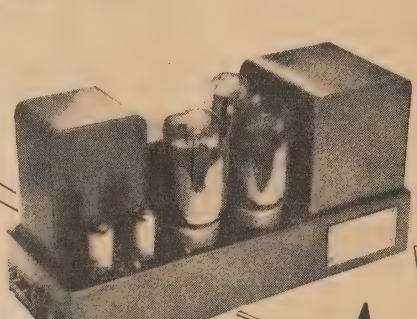


Fig. 2. Same as for Fig. 1 except that mike is 30 degrees off axis. (A) is response without and (B) is with diffuser.

for the closest approach to the original sound



Acoustical

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The criterion, as always, is that the reproduced sound shall be the closest approach to the original—that the enjoyment and appreciation of music may be unimpeded. This is reflected throughout the design of the QUAD II. It is reflected, too, in the straightforward and logical system of control, achieved without the sacrifice of a single refinement or adjustment capable of contributing to the final objective.

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- **ADELAIDE:** Gerard & Goodman Ltd., 192 Rundle Street; Newton McLaren Ltd., 17 Leight Street; Radio Electric Wholesalers Ltd., 26 James Place.
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RH/5/58

is of course elementary to say that ing facilitates subjective tests as h as a point of reference. I never to pass a final opinion on the ormance of any speaker until I have an opportunity of comparing it tly with the best available. In the e way, live **versus** recorded com- sons in a good concert hall are luable.

NEL VIBRATION

anel vibrations in poorly constructed osures give much the same effect one breakup, although at lower fre- ncies around a few hundred cycles- second. Such resonances produce stiness" and are quickly exposed by with male speech. The only solution gid construction using heavy timber, l-filled panels and/or, best of all, crete or bricks.

transient is an energy pulse where intensity changes over a wide range very short time. A hand-clap is an mple of a sound with steep starting sients at high frequencies, but the ination is of equal transient signi- ance. Wide frequency range and ab- ce of hangover or ringing are clearly essary for good transients of both eties.

ven the centring device has an effect high-frequency performance and sient response. Corrugated discs are used on the majority of loud- akers because of speed of assembly, centric reliability, and dustproofing gap. But the open spider made of Bakelized fabric may give slightly er high-frequency performance and ch finer and harder and this device proved transient response.

here are two main reasons. The disc made with a neck about 1/16in in th which is necessary for gluing device to the cone and coil assembly. s has a damping effect on the trans- sion of the highest frequencies from to cone.

ONE SPIDER

The edge of the Bakelite spider is ch finer and harder and this device has a very quick restoring action cone movement which cleans up the nsient nature of the reproduction to audible degree on A-B testing.

t would be difficult to over-emphasize importance of directional effects in idle and upper registers when natural roduction is the objective. High-fre- ncy beaming is often objectionable. en in the Royal Festival Hall the ct of tilting middle and treble units wards or to an angle of 45 degrees be observed by a listener at the back of the stalls at a distance of more than 100 feet.

In fact, I would go so far as to say that satisfactory reproduction in a concert hall is impossible if these directional effects are not carefully studied and controlled.

One of the simplest ways of spreading an objectionable beam and reducing peaks at 1-5 kc. resonance is to fit the well-known "KB" slot in front of the cone as illustrated at the left in Fig. 5.

The length of the slot should be the same as the piston diameter of the cone, the width being determined according to the frequency range involved; it is most effective when it is less than the wavelength. Thus 1in wide will answer for frequencies up to 13,500 cps. With a 5in speaker, a slot 3in long and ¾in wide is about right.

The device worked wonders in a schoolroom with large windows and hard walls, where the reproduction of speech is often incoherent.

The oscillograms of Figs. 1 and 2 show the effect—on and off axis—of placing the slot diffuser in front of an 8in unit which gives excellent results in a small Helmholtz resonator but needs some control in the 1 to 5 kc. region when mounted on an open baffle.

For this test, the speaker was mounted in a wall facing outside—probably the best arrangement ever devised for speaker measurements. The microphone distance was 18in—rather close—but the object was to study the effect of the diffuser rather than to produce an accurate response curve.

OFF-AXIS RESULTS

It will be noted that the output on-axis with the diffuser is about the same as 30 degrees off-axis without the diffuser. The use of the diffuser greatly reduces the difference between axis and off-axis results.

In short, there is much to be said for the device at frequencies above 1,000 cycles, but with a single speaker covering the entire range there is severe obstruction at low frequencies. This can be largely overcome by altering the shape of the slot and adding extra holes, as shown at the right in Fig. 5.

Suitable dimensions for general use are:

Speaker	8"	10"	12"
Width of slot	1"	1"	1"
Diameter of four circles	2"	2½"	3"
Length of straight portion of slot	3"	3½"	4"
Over-all length of main slot	7"	8½"	10"

(Continued on Page 79)

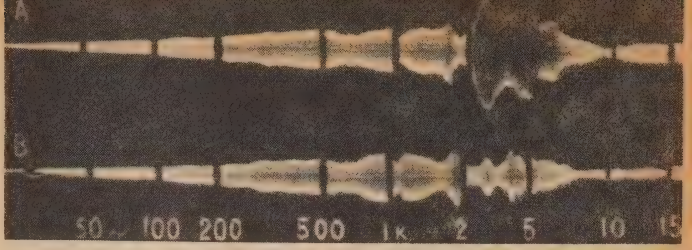


Fig. 3. Oscillograms of response of 8in speaker with metal discs on cone. Curves taken in open air at an input of 1 watt. Mike is at 18in on axis. Speaker mounted in wall. (A) shows the response with a normal 7in diameter hole in the baffle. (B) is response with modified diffuser of Fig. 5 placed in front of normal baffle.

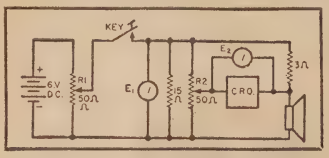


Fig. 4. Here is the circuit (after E. M. Price) used for transient tests.

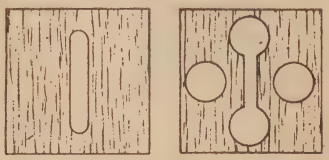
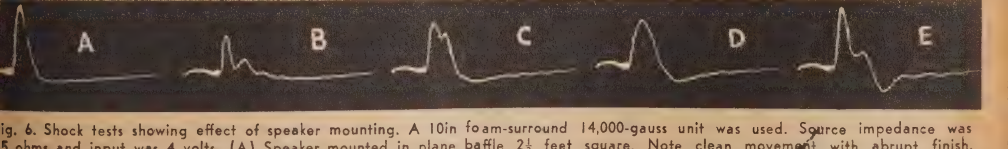
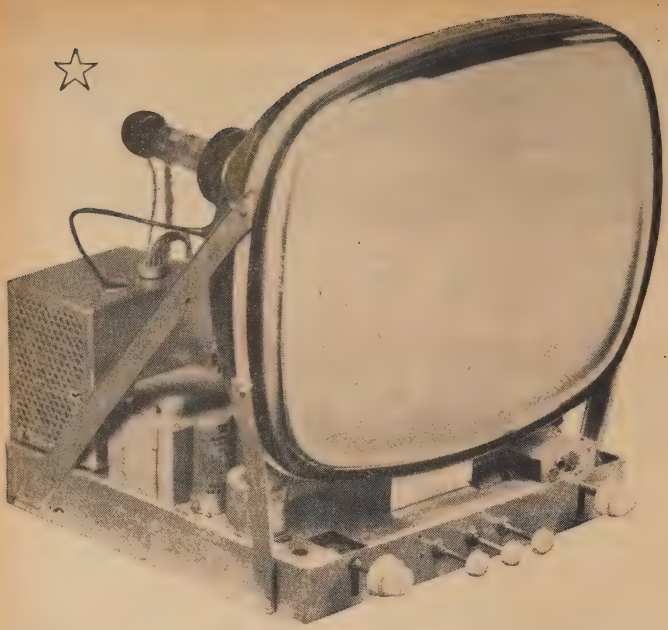


Fig. 5. Appearance of the Kolster-Brandes Ltd. slot diffuser is shown at the left. At the right is shown a modified diffuser designed for use with a single speaker. This diffuser avoids resonance and restriction of output at the lower audio frequencies. Quarter-inch or ¾in plywood may be employed.



ig. 6. Shock tests showing effect of speaker mounting. A 10in foam-surround 14,000-gauss unit was used. Source impedance was 5 ohms and input was 4 volts. (A) Speaker mounted in plane baffle 2½ feet square. Note clean movement with abrupt finish. B) Speaker in 2 cu. ft. reflex cabinet. Cone movement reduced, ringing drops off at exponential rate. (C) Corner horn-loaded eflex cabinet made of ¾in plywood. Uneven kink with continuous ringing. (D) Large exponential horn, 5½ feet long, 4 foot mouth, eighing 175 lbs. Note ringing from metal horn in spite of heavy construction. (E) Brick 9 cubic foot corner enclosure employed for the speaker. There was a large movement of cone with low resonance frequency.



Here is our new, 1958 model TV receiver, photographed with a 21-inch tube in position. The same chassis may be used with currently available 17-inch 90-degree tubes. Controls are Volume and Brightness on the left, Line Hold Frame Hold and Contrast in the centre, with Channel and Fine Tune on the right.

position can only benefit from retain the one standard chassis. You can the fore build this new set on an exist chassis by drilling a few extra mount holes to suit currently available co ponents. Even this chore will be elim ated when we can get around to p ducing a slightly revised blueprint.

Actually, some additional econo has been made possible by eliminat all underneath brackets and extens spindles.

You will note that the picture t is shown mounted on the chassis pro by the same means as adopted for 21in receiver. An exactly similar meth can be used for the smaller 17in tub

TUBE MOUNTING

Originally, we had "purist" ideas ab protecting the tube from the construc (and vice versa) by hanging it perm ently in the cabinet. Whether th ideas are justified or not, set-build have clearly preferred to accept w risk there may be and to adopt chassis-mounting method.

We can only repeat the warnin that a picture tube may implode i bumped or scratched or stressed un duly near the neck. Apart from th value of the tube itself, there is very real danger, particularly t eyes, from fragments of flying glass

In factories and service depots, wh tubes are thus exposed, operatives often required to wear unbreaka goggles for their own protection—so careful!

As regards cabinet styling, the mo ing arrangement pictured lends itself

Build This New TV Receive

Just twelve months ago, we launched Australia's first major television home-construction project, with a 17-inch receiver, followed in November last by a 21-inch version. The new 1958 receiver, described here, is developed from these earlier and very successful models and is designed to use the latest 17 or 21-inch 90-degree picture tubes.

THOUGH it is, in fact, only a year since the first article appeared, television set-building has been firmly established in Australia, both as a hobby and as a medium for self-instruction.

Literally hundreds, in fact, thousands, of sets have been built by readers, who range from near-beginners to "old hands" at the game; from radio amateurs to professional servicemen and dealers.

COMPONENT SUPPLY

To the more ambitious parts distributors, the supply of TV components has become an important part of their business, even though they have had to battle very hard for some of the essential items.

From our point of view, it has been gratifying to note the very small percentage of readers who have encountered any real difficulty as a result of their television efforts. Where our original designs have been followed, the troubles which have occurred have been of a strictly secondary nature, and we have had no reason to regret our overall choice of components and circuitry.

Not surprisingly, therefore, our new sets look much the same as the earlier ones and it is, in fact, the original 21in chassis, modified to include as many changes as seemed desirable.

The physical layout may easily have been altered this way or that but it is difficult to see how it could be made any simpler than at present. Perhaps next year, if new and shorter tubes are available, it may be worth while to use a narrower chassis or even a completely different mechanical layout, but the step is not warranted at present.

In the meantime the supply and cost

by **Neville Williams**

the simple "table model" approach, w or without legs, as suggested for original 17in receiver. The main ference is that a couple of simple cl only are needed to hold the safety g and mask in position, when the tub supported on the chassis.

Alternatively, an upright console rangement may be preferred, as gested in the April issue, permitting use of a larger loudspeaker, facing ward.

ALTERNATIVE MOUNTING

Possibilities do not end here. I obvious enough that the tube could mounted with the narrow dimension jacent to the chassis. The whole ass bly may then be turned on its side, w the chassis sliding between cleats on right-hand wall of the cabinet and tube resting, for extra support, o padded block on the cabinet itself.

This would bring the knobs in a tical line down the right-hand side the cabinet, with the tuning controls the top, in line with some commer

REAR VIEW OF THE COMPLETED 1958 TV RECEIVER

This rear view of the chassis shows the picture tube mounting arrangement and most of the majo components. Note that an aerial lead-type connector is strapped to the side of the chassis, also that the yoke leads plug into a socket on top of the EHT cage.

signs. We may have more to say later out cabinet work but the foregoing ll at least be a guide to those who ay want to get on with the job.

And what of the choice of tubes, 17 21in?

Our original receiver was an exclu-ely 17in model, based on the use of tube where the electron beam needed be deflected through a nominal angle 70 degrees.

When we described a 21in version, it s necessary to replace certain of the e deflection components with others pable of a 90-degree beam deflection. e 21in tubes were designed this way to permit use of the larger screen without at the same time making the tubes unduly long.

These same 21in tubes are still current but, in the meantime, 17in tubes have become available, using 90-degree deflection and therefore a good deal shorter than the original 70-degree types. They can, in fact, be mounted on our present chassis, without overhang.

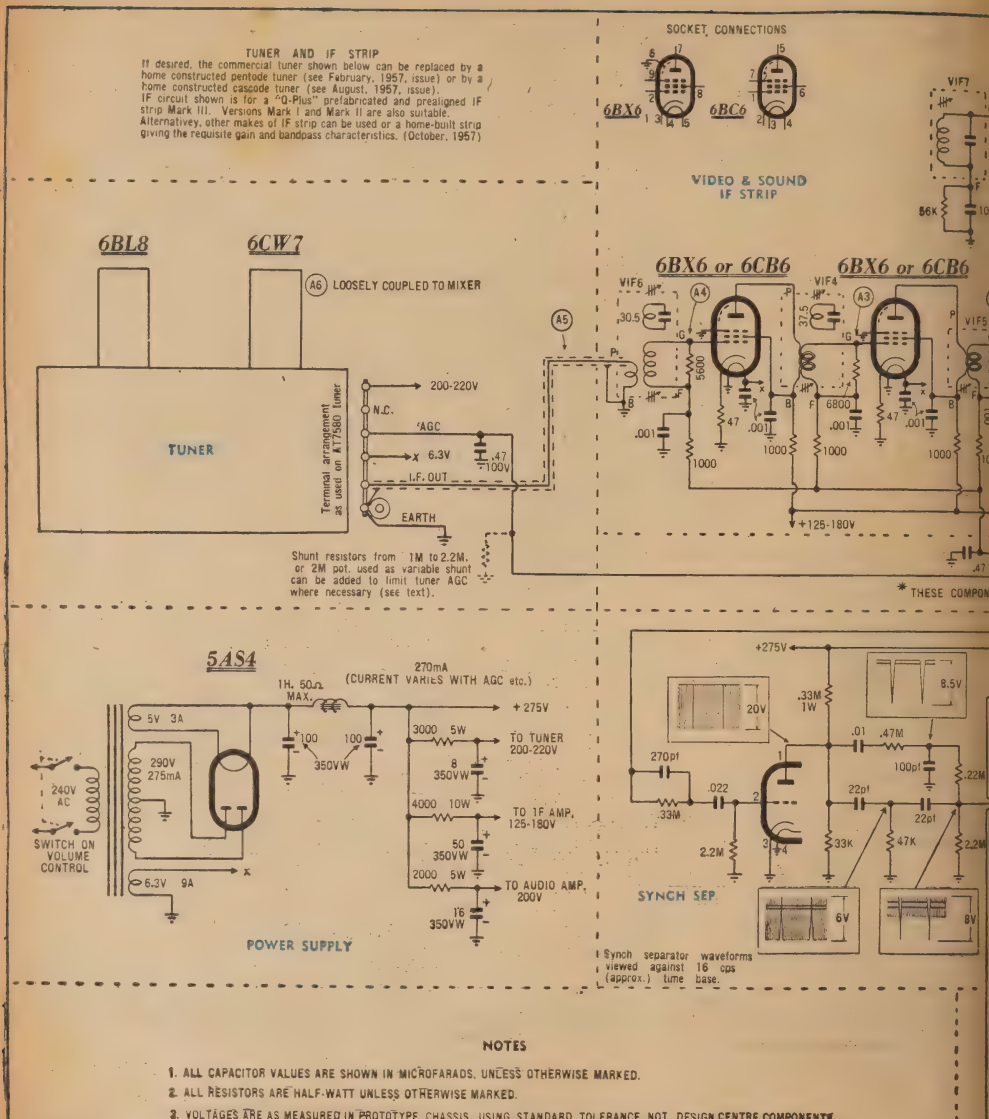
In terms of EHT supply, focusing method and socket connections, they are completely interchangeable with the 21in types. We are, therefore, able to describe the one basic chassis and it is only a matter of attaching the appropriate support brackets and plugging in the appropriate picture tube to have a 17 or a 21in version.

Four possible tubes types are shown in the circuit diagram, which are all interchangeable if the socket is wired as indicated.

The actual choice of screen size remains, as ever, a question of preference, room dimensions and visual acuity.

If only three people are to watch the set regularly and the viewing distance from eye to screen is around eight or nine feet, preference might easily be for the 17in tube. The smaller pic-

CIRCUIT DIAGRAM OF OUR 1958 TV RECEIVER



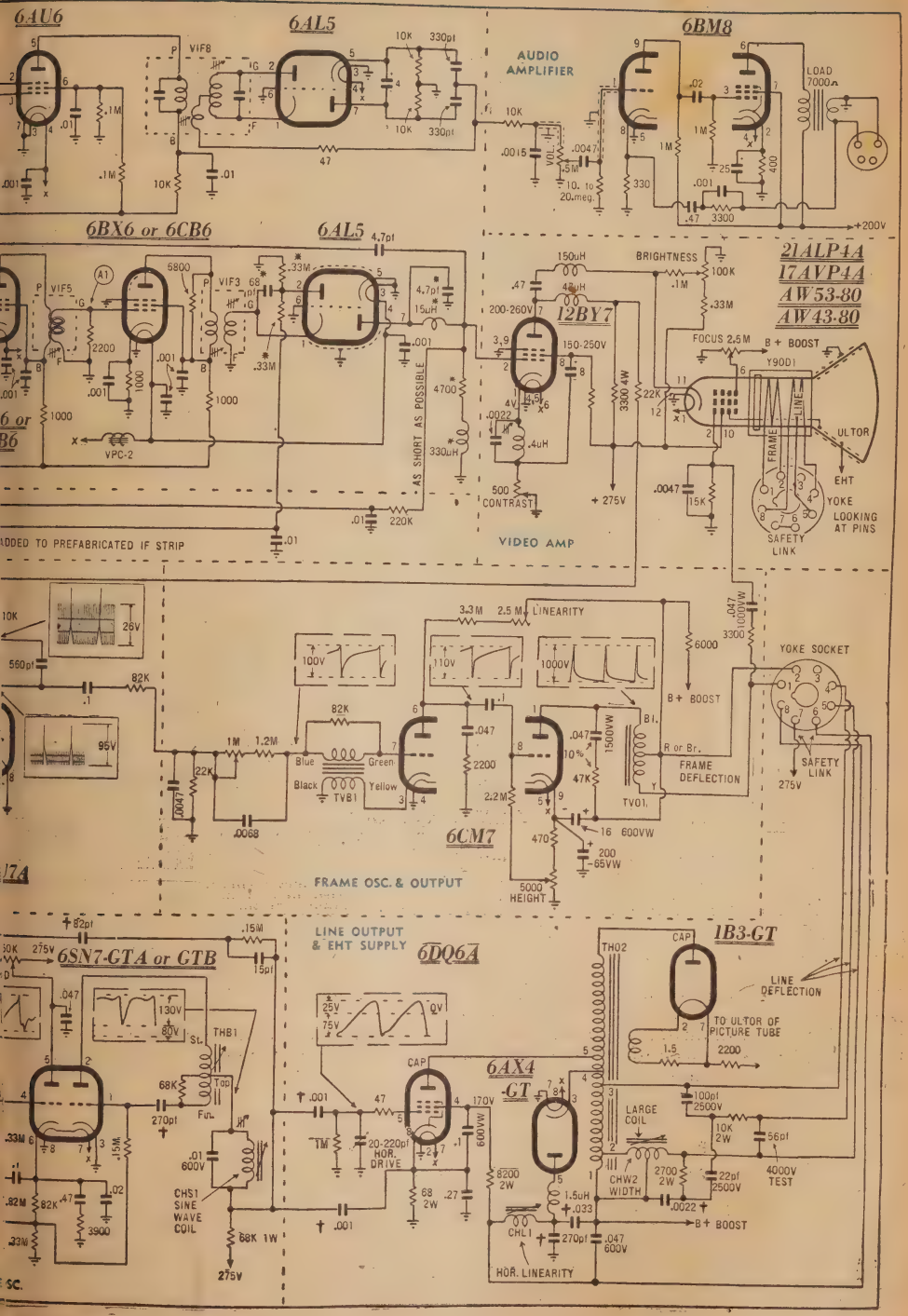
NOTES

1. ALL CAPACITOR VALUES ARE SHOWN IN MICROFARADS, UNLESS OTHERWISE MARKED.
2. ALL RESISTORS ARE HALF-WATT UNLESS OTHERWISE MARKED.
3. VOLTAGES ARE AS MEASURED IN PROTOTYPE CHASSIS, USING STANDARD TOLERANCE NOT DESIGN CENTRE COMPONENTS.
4. ALL RESISTOR VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE MARKED. (M = MEG., K = ×1000)
5. † 1000VW.

1958 TELEVISION RECEIVER

DRAWN: M.W.H.

ALL IMPORTANT VOLTAGES AND WAVE FORMS



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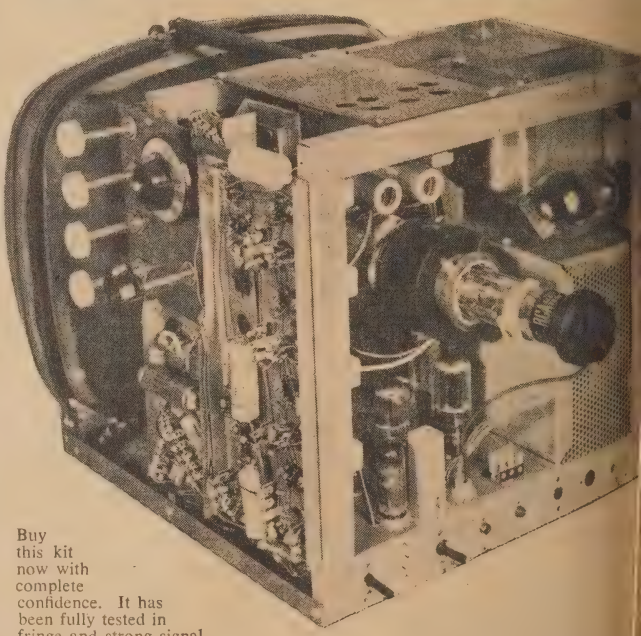

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BRIEF SPECIFICATIONS:

Circuit Function and Valve Types

Power Supply (5AS4)

Primary taps for 200, 220, and 230 V. operation, full wave rectification with capacitive input filter. A 300 mA fuse is incorporated. Mains transformer has copper shield for minimum external field.

Tuner (6BO7A, 6U8)

Q plus type VTT/1 10 channel turret tuner featuring low noise 'Cascode,' R.F. amplifier and high mu mixed oscillator. Special moulded coil formers prevent cores from coming loose. Special "alkyd" low loss high stability plastic used on all coil biscuits and mouldings. Oscillator is compensated for frequency drift due to variations in temperature. This unit comes fully tested and pre-aligned.

Video and Sound I.F. Channel (4-6CB6, 2-6AL5, 1-6AU6)

The ever popular Mark III I.F. strip, four stages of video amplification using bifilor and an over-coupled stage. Video detector, with R.F. filter and video detector load, intercarrier taken from video detector. Sound amplifier/limiter stage and ratio detector, fully tested and aligned

Audio Amplifier and Output (6AV6, 6AQ5)

A triode voltage amplifier with beam tetrode power output. Negative feedback is applied to the 6AQ5. F.M. de-emphasis is obtained by a simple R/C network. Frequency response 90 c/s—5Kc/s at 6 db.

Video Amplifier (12BY7)

A high gain pentode using a combination of series and shunt peaking. Video detector is directly coupled to video amplifier grid. Output is capacitively coupled to picture tube cathode. The gain (contrast) is controlled by a cathode potentiometer. Frequency response up to 4Mc/s at —6 db. and greater than —40 db. at 5.5 Mc/s.

Sync. Separator. Sync Phase Inverter (12AU7)

Sync pulses are obtained from the output of the video amplifier and applied to the sync clipper which removes most of the video content, and provides a substantial degree of noise immunity.

Frame Oscillator and Frame Output (12BH7)

A frame blocking oscillator is used. The frame output stage drives the deflector using an auto-transformer to match the output to the yoke impedance.

Line A.F.C. Line Blocking Oscillator (6SN7GTA)

The line A.F.C. is a D.C. control valve to correct the line blocking oscillator which used a "sine wave" stabilising coil. Small changes in sync control are obtainable by a pot. on the D.C. control valve. Once aligned correctly, this circuit will remain in sync, over long periods, with varying signal strength and mains variation.

Line Output. E.H.T. Supply 6DQ6A. 1B3-GT. 6AX4-GT)

The line output/E.H.T. transformer (Q Plus VHOPT/1) (auto-transformer type) and the E.H.T. rectifier are shielded in a metal case and cover. Provision is made to alter this section for higher tiltor voltage suitable for a 90 degree 21in picture tube.

A.G.C.

"Simple" type, supplied from video detector ouput. An area control is provided which uses part of the negative input to the line output grid. This negative voltage is filtered and applied via a potentiometer ("area" control) and the Tuner A.G.C.

Chassis

The main chassis comes pre-assembled, ready to take the power supply, line output/E.H.T. cage, tuner, video and sound I.F. channel, frame oscilator and output sub-chassis. The picture tube mounting, strap, etc., are screwed to the main chassis, making it one complete unit.

Controls

Channel selector and fine tuning are a dual concentric knob, volume off-on, brightness, contrast, frame hold, line hold, controls are grouped together and fitted with smaller knobs. **Picture Tube** new type 17AVP4 17in 90 deg. tube, only 16in in length. Frame height, frame linearity, line drive, line oscillator, line sine wave, controls are mounted on the rear of the main chassis. All these controls can be adjusted without removing the back of the cabinet.

Picture Tube, new type 17AVP4 17in 90 deg. tube, only 16in in length.

ook somewhat sharper, close up, ss obvious line structure and less in fringe areas, where noise may roblem.

17in tube is cheaper to buy—replace later—and smaller cabirk may likewise be an advantage room space is at a premium.

a bigger room and audience, or ople with poor sight, the larger will usually be preferred, simply e it is larger. A 21in screen does ntain or present any more detail 17in but it does allow the picture viewed in comfort from a greater e.

CIRCUIT

nuch for the "mechanics" of the r. It may be helpful at this junc- review the electrical circuit, both ientate" new constructors and to oints where it differs from the designs.

s will be evident, these earlier ivers can be brought up-to-date, whole or in part, quite simply.

tuner shown is the same Mullard lips type AT7580, as used in the receiver. It is a self-containing ith provision for signal and power and delivering its output by coupnk and a short length of coaxial to the input of the IF channel.

other comparable tuner, which e accommodated physically, may stituted or one of the home-built described in February and August,

We have ideas about a new, ied, home-built tuner, but have not ie opportunity as yet to put them ractical form.

the new circuit, more extensive is applied to the tuner, causing F amplifier drain to vary more with signal. The tuner supply r has accordingly been increased vent excessive voltage appearing on cillator circuits when the RF stage vily biased.

position in respect to the IF chanmore open and several approaches ssible.

original 17in receiver used the s" Mark 1 prefabricated and pre- strip, with the possible substitutf the Mark II strip for fringe Some distributors still hold stocks e units and they can be used with confidence.

IE-BUILT STRIPS

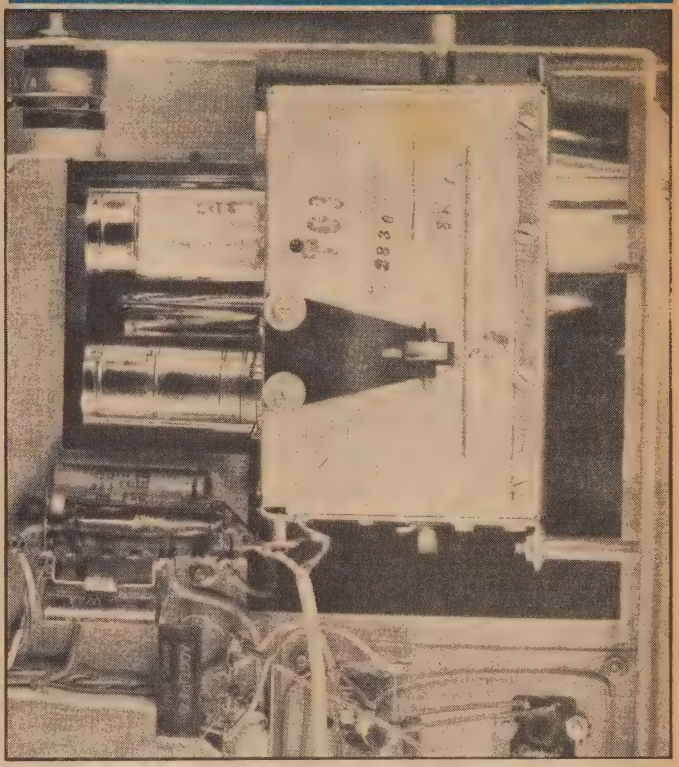
owing the original article, it beevident that many constructors ed to save money by building own strip, using identical com- and circuitry. We accordingly ied an article to assist them in gust, 1957, issue, giving the requiout, wiring and alignment data. o, is still valid for those who are to use it.

il later, for our 5in receiver, we ed a completely home-made strip, ome-wound coils and ex-disposals alves (October 1957, issue). This e so successful that we suggested ible use in the 21in receiver and ul also be used, if desired, in this odel.

ng to the picture, other manufacave since released basic formerssis kits, ready-wound transe, prefabricated and prealigned hile "Q-Plus" have come to light Mark III strip which supersedes iginal Mark I.

e ave not been very happy about

CLOSE-UP OF TUNER MOUNTING



This close-up underneath view shows the tuner mounted in its specially shaped cutout in the front corner of the chassis. Note the tagstrips in the lower left-hand corner supporting the supply components for the tuner and IF strip.

some of the components which have resulted from this spate of activity and we suggest that readers be wary of superseded "bargain" strips, cores which wind sloppily in makeshift threads and very thin gauge moulded formers, which can distort with pressure and heat.

Apart from the actual components, it is necessary to emphasise that IF strips must be wired carefully. Changing the basic layout, failure to orientate sockets properly and using unsuitable bypass components can all lead to regeneration, making it IMPOSSIBLE to align the strip properly.

Correct and stable alignment is the key to obtaining good pictures and sound and can make all the difference between a good set and a very poor one.

ORIGINAL PHOTOS

ORIGINAL, unlabelled, glossy photos from which the blocks in these pages were made are available through our query service at the following prices:

8 x 6 inches (each) 5/-
10 x 8 inches (each) 7/-
12 x 10 inches (each) 8/9

When ordering, state clearly which photographs are required.

Before you buy anything in the way of IF components, therefore, think carefully what your position is going to be in respect to the alignment problem.

An IF strip using bifilar transformer throughout (as did our 6AC7 unit) can be aligned reasonably well using some form of output meter and a signal generator or modulated oscillator covering the 30 Mc region. It needs these instruments and patience but it can be done!

AFTER-SALES SERVICE

If you lack these necessities, or prefer to buy components for one of the more elaborate commercial strips, make sure that your supplier is willing and able to assist with an after-sales alignment service.

The same is really desirable, even with a completely prefabricated and prealigned strip. Our experience with these has been that they will always get pictures and sound, as installed. However, the physical and electrical disturbances of wiring them into a different chassis and associating them with a different tuner is sufficient to distort the response curve to a degree.

The chassis, as pictured, and the circuit show the "Q-Plus" Mark III strip but with one important amendment.

Our earlier designs used the simplest possible AGC system, the control volt-

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of questionable quality.

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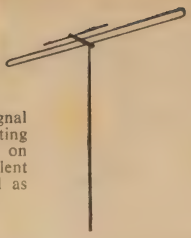

For primary signal areas where ghosting is no problem on high band. Excellent loft fitting as well as outdoors.

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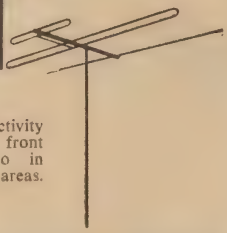
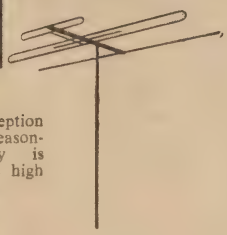


Excellent directivity and maximum front and back ratio in medium prime areas.

RETAIL £7/17/6



For good reception areas where reasonable directivity is needed for both high and low bands.

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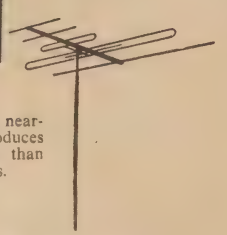
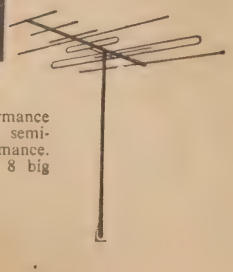


6 elements for near-fringe use. Produces clearer pictures than any in this class.

RETAIL £11/11/-



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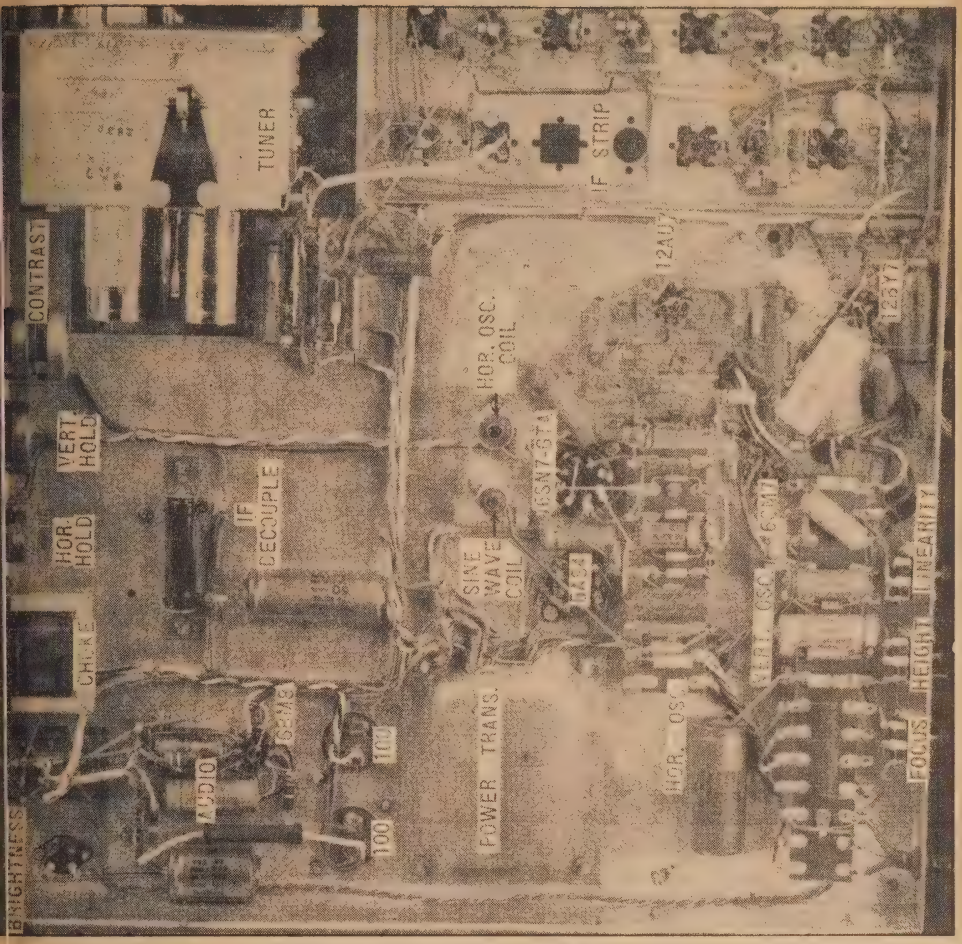
N UNDER-CHASSIS VIEW OF THE NEW TV RECEIVER



nderneath view of the chassis. Elimination of the shields and extension spindles gives an even cleaner appearance than earlier els, without sacrificing performance. Note that the horizontal oscillator coil is now mounted alongside the sine wave coil, with access to its adjustment above the chassis.

eing picked up from the video dur diode. This proved adequate ost localities but did allow over- ffects to be evident where the al or the use of a high-gain aerial led excessive input signals.

earching for a more effective sys- e have reverted to a circuit which ver common in AM broadcast re ve. In short, the second unit in 6L5 video detector has been wired a hunt-fed diode to generate sepa- GC voltage.

o our present purpose, there is a ti advantage in this circuit. Since cond diode can operate into a higher load than the video detec- tification efficiency is greater and elers more DC output for the same ir ut

ther point is that the diode, as ed rectifies the alternate half-cycle of input, which is not subject to loading by the video detector.

As a result, the AGC voltage available is approximately twice that from the video detector. This higher voltage is fed to the tuner, where it is most needed, leaving the smaller voltage from the detector to control the IF system.

Tests have shown that the dual AGC system can, in some respects, be too efficient, the RF amplifier being driven almost to cut-off, with only very limited gain reduction in the IF channel. This can expose the picture on strong channels, quite unnecessarily, to noise or other spurious interference problems arising in the IF amplifier.

The effect can be combatted by installing a potentiometer to control the AGC bias applied to the tuner or by simply shunting the tuner AGC line with a fixed resistor, as indicated in the circuit.

The desirability of such measures is best judged in the individual receiver, in its final location. In typical receivers shunt values between about 1.0 and 2.2 megohm proved satisfactory, giving AGC levels on fairly strong signals about 7 volts on the tuner and 4 on the IF amplifier.

The point of all this is to give the receiver improved tolerance to very strong input signals.

In fringe areas, the question of overload does not arise and extensive AGC to the tuner is not necessary. In fact, there is good reason, in such a case, to shunt the tuner AGC quite heavily, so that the front-end gain always remains fairly high.

The only other point of note about the IF system is that the supply resistor is now increased in value. This is in line with the manufacturer's expressed

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C1/3 20H/125mA	76/6
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.1/400	1/9
.1/600	2/
.25/200	2/
.25/400	2/5
.25/600	2/11
.5/200	2/7
.5/400	3/11
.5/600	4/1

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T1/20 80 mA/385 V/2 v 6.3 V 5V	61/7
T6/18 100 mA/285 V/2 x 6.3 V 5V	61/7
T6/26 100 ma/385 V/2 x 6.3 V 5V	66/
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2 x 5 x 2	
2 x 5 x 3	
3 x 3 x 1	
3 x 3 x 2	
3 x 3 x 3	
4 x 2 x 1	
4 x 2 x 2	
4 x 2 x 3	
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6 x 2 x 3	

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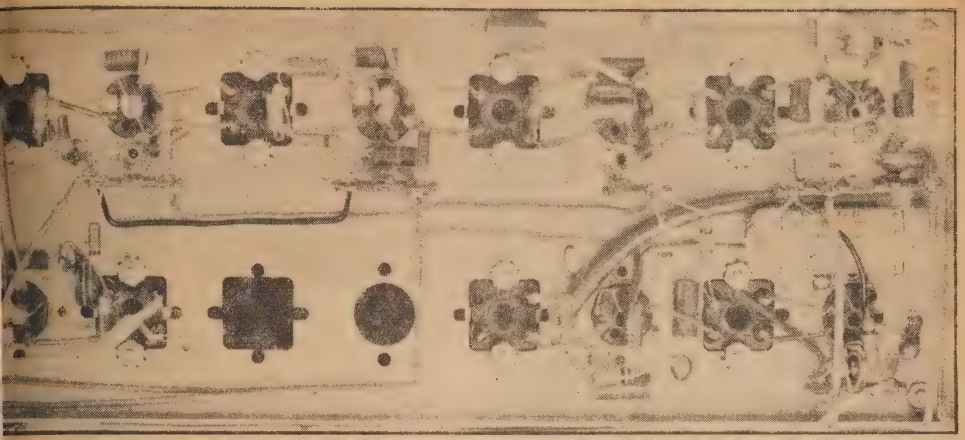
WIRING DETAILS OF THE PRE-FABRICATED IF STRIP



ose-up of the prefabricated Mark III Q-Plus IF strip with the RF input coax. cable coming in at the bottom left and the and audio outputs at the right. Readers, who may choose to buy components separately and build their own strip, would be wise to follow this layout closely.

that the range of operating voltage vered somewhat from the previous

video amplifier is the standard ain pentode arrangement, as used i, with shunt and series compen- in the plate circuit.

riously, the Contrast Control in thode circuit was mounted on a t near the centre of the chassis erated from the front by a long on spindle. The control may be to the front of the chassis, to this complication, provided the e lead is run in LOW CAPACI- E coaxial or microphone type The earth return should be made the braid only, grounded near eo amplifier socket.

HODE COMPENSATION

h resulting shunt capacitance is to be in the 40-50pF region, will give slight cathode circuit sation with the Contrast Control towards its maximum resistance A further 50pF may be added he Contrast Control end of the trap coil to an adjacent earth to make up the total of 100pF. the earlier circuits.

Vhether this is desirable or not will r largely on individual receivers possible tendency for some to video ringing with too much e compensation.

o that the screen bypass is now nd to cathode instead of to earth, il of the video amplifier appearing omewhat improved thereby.

acitance coupling has been re- ed between the video plate and n tube cathode, the reasons for ainst this principle having been ussed recently, at some length, in the "Buy An Argument" columns.

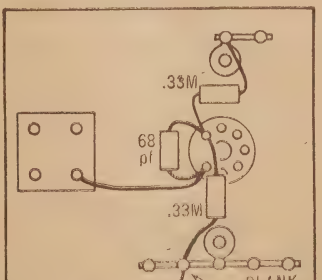
ion of the video signal is diverted the synch. separator stage and eforms in detail to the revised uit featured last month. Since the n and advantages of the circuit iscussed at some length, there should be no need for repetition here.

The revised synch. separator involves some change to the input circuit of the frame blocking oscillator, particularly the wiring to the Frame Hold Control. Physically this control has been moved forward to the front lip of the chassis and connected into circuit by a pair of twisted leads. This appears to involve no electrical complications.

Output from the frame blocking oscillator drives the second portion of the 6CM7 dual triode, serving as the frame output stage. This operates from a plate supply potential of about 500 volts derived from the line output "B-Plus Boost" circuit.

Note that the 16mfd B-Plus boost filter capacitor is now returned to the cathode of the 6CM7 output triode, where it functions equally well and with considerably less applied voltage.

The line oscillator operates in conjunction with the well-known "synchroguide" automatic frequency control circuit, with a potentiometer as the Line Hold control, as in the 21-inch receiver.



Three components added to Mark III IF strip as shown will provide more AGC bias for the tuner. A spare lug in the original unit provides a handy anchor point for the feed resistor.

This drives a 6DQ6-A line output valve, which is mounted in the EHT cage along with the line output transformer and its associated picture controls, the 6AX4 damper diode and the 1B3-GT EHT rectifier.

One significant change has been made in this portion of the circuit.

We have previously provided a pulse line from the cage for possible use with a keyed AGC amplifier and as an additional reference pulse for the synchroguide circuit. This last is a very secondary function and the dual AGC system just described has further removed the likelihood of constructors wanting to add keyed AGC.

As a result, the pulse line has been omitted, effecting an immediate saving of three capacitors, two of them high voltage types.

What is no less important, elimination of the pulse lead and the radiation therefrom has removed a major hazard to the interlace, making it possible to omit the shield bracket separating the line and frame components. The physical separation afforded by the layout as shown, is now sufficient.

EHT CAGE

We have also revised the layout of the EHT cage wiring to improve accessability and to avoid trailing leads but more about this later.

The audio system is conventional, as also is the power supply. One slight change has been made in the latter, in raising the permissible DC resistance of the filter choke to 50 ohms. The slight extra voltage drop is offset in part by reduced tuner and IF drain, but more important, the specification allows a much cheaper filter choke to be used.

In building the receiver, we suggest that you instal and wire the tuner, IF strip, audio system and power supply, which will enable you to receive the sound side of the programs as a first step. Additional circuits can then be added in order and checked progressively, if possible with a CRO.

This orderly progress will ensure some

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al satisfaction and also avoid the
blem of having too many things to
y about at the initial switch-on.
s a first step, we suggest you check
mounting of the tuner. Remember
the tuner box must not protrude
w the chassis, while valves or other
ponents protruding too far above the
sis may necessitate raising the pic-
tube to an unwieldy height.
ach individual type of tuner must
reated on its merits, and the mech-
al work done preferably before any
r components are mounted.
he neatest way to mount the Philips
Mullard tuner is to make an extra
ut in the chassis (if not already pro-
d) to accommodate the valves, lying
their sides. The extra cutout sug-
ed is a rectangle measuring 2¼in x
and located 1 5/16in from the front
he chassis.

NER SHAFT

me thought must also be given to
ength of tuner shaft protruding from
front of the chassis. It must match
coaxial shafts selected for the
me/Brightness potentiometer on the
r side, and both must fit in with
et requirements. The point behind
is that coaxial shafts cannot easily
rimmed; the correct length must be
ted at the outset.
as in our case, you want the shaft
e as long as possible, the front
ket of the tuner can be trimmed.
ly grip it in the jaws of a vyce with
one supporting the tuner body, and
it back to ¼in wide, just enough
ccommodate a new 1/8in mounting

ill holes in the side of the chassis
it this new mounting hole and those
dy in the rear bracket, then pro-
a set of long bolts, nuts, washers
spacers to mount the tuner firmly
sition. Make sure that the valves
be withdrawn, in case replacement
ld be necessary later.
this stage, it would be wise to
also the mounting holes for the
trip, making any necessary amend-
s to the chassis so that the strip
be bolted easily into position. If
a prealigned unit, it should not be
cted to unnecessary handling or vi-
on.

WER, AUDIO CIRCUIT

ving made sure the tuner and IF
can be fitted, put them aside while
instal and wire the power supply
audio circuitry. There is nothing
l or critical about this, but you
be assured of a neat result by fol-
ig our recommended procedure.
e primary wires can be terminated
ree end lugs of the terminal panel
ie rear of the chassis, the power
terminating on the three opposite
of the relevant lugs can be bridged
s directly, the other two being join-
ia one pole of the "off-on" switch
: rear of the Brightness/Volume po-
meter.
ring to the rectifier socket is
htforward, but the 6.3v. heater wir-
arrants special comment.
ause of the considerable heater
of a television receiver, individual
former manufacturers may provide
ate 6.3 volt windings, or parallel
with the ends enclosed in a com-
sleeve or, yet again, a centre-tapped
volt winding.
ther than try to terminate the bulky
at a valve socket, the ends of the
should be tinned and terminated

at a small tagstrip adjacent to the transformer. From this point wires can radiate to individual sections of the receiver, so that the total heater load is distributed over three or four leads and fairly equally between the windings where more than one is provided.

One side of the winding (or windings) or the CT of a 12.6 volt winding can be earthed and you can please yourself whether a twisted pair is used thereafter or the chassis used as the earth return for all sockets.

If a twisted pair is used, make sure that you do not inadvertently short out the heater winding by earthing the wrong lead at some other point.

Earth the high tension secondary CT in only temporary fashion to begin with. If testing the receiver with less than the full drain applied, a heavy duty resistor of about 300 ohms, wired in series with this lead, will keep the volts somewhere near normal. As indicated on the circuit, the HT voltage should be about 275.

The position of the filter choke and capacitors is obvious from the photographs, the only necessary precaution in regard to the latter being to watch their polarity. A red spot or red end indicates the positive connection.

AUDIO AMPLIFIER

Having completed the power supply, the audio system, involving a 6BM8 triode-pentode, can logically be wired in next. The exact disposition of the socket pins in relation to the mounting holes will vary with the type of socket but the space between pins 1 and 9 should be located towards the side or front corner of the chassis.

The layout and circuit assume the use of a manufacturer's type speaker output transformer, which will normally have a secondary to match a 2-ohm voice coil. This will cater for any likely speaker from a 6-inch to one of the light-duty 12-inch wide-range types.

If you have more ambitious ideas about the speaker system, it may be necessary to mount a larger output transformer elsewhere, to keep the speaker well away from the picture tube and to recast values in the feedback network.

Most of the wiring components to do with the audio system can be anchored between the socket pins and a single 8-tag strip mounted just behind the composite Brightness/Volume control. The method of wiring should be clear enough from the detail photograph and the accompanying diagram.

When completed, the audio system and power supply can be tested, using a temporary voltage dropping resistor, as mentioned earlier, and any suitable source of signal.

The feedback will need to be phased and this may involve reversing either the primary or secondary leads of the output transformer. Connected the wrong way round, the audio system will probably squeal, even with the volume turned right off. The correct phasing should give stable operation with reduced gain, relative to the no-feedback condition.

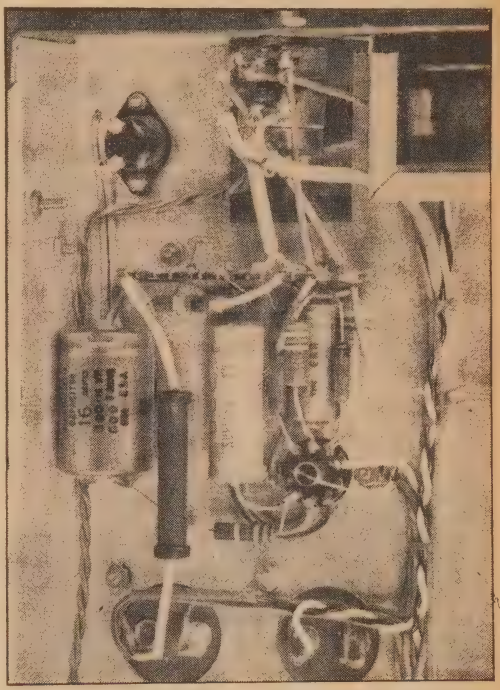
With the power supply and audio system installed and tested, the logical next step is to mount and wire the tagstrips which terminate the input and output leads for the tuner and IF strip.

It may be argued that these are not strictly necessary but they support certain essential components and, by looping across to equivalent points in the tuner and IF strip, these latter items can be installed and removed very easily without disturbing other components.

TUNER SUPPLY

An 8-tag strip for the tuner supply is mounted just alongside and to the rear, as shown in the underneath photograph. The lug furthest from the tuner provides a junction point for the active heater lead, the other side of the heater circuit in the tuner being normally grounded to frame.

The second lug on the strip is "earthy" and the third can be used as a 275-volt



Here is a close-up view of the audio wiring, concentrated around a single 6BM8 triode-pentode. A wiring diagram for the tagstrip is given overleaf.

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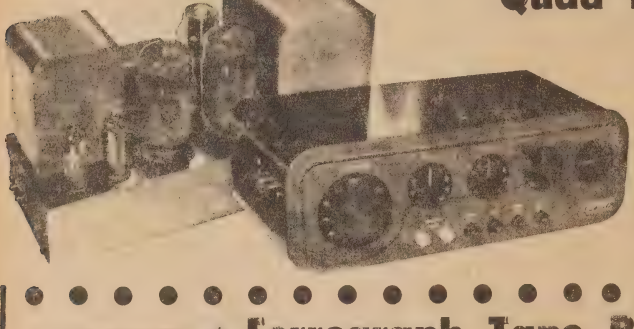
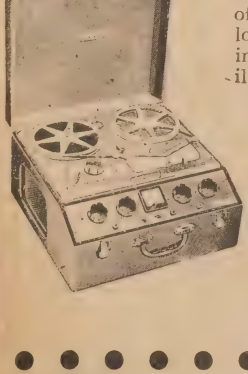
Quad II Amplifier



The acoustical Quad II amplifier and Q.C.2 control unit are generally recognised as giving the closest approach to the original sound. You should see also the Acoustical F.M. tuner which goes with the Quad II. U.R.D. also stock many other makes of amplifiers including the excellent Rogers R.D. Junior.

Ferrograph Tape Recorder



A tape recorder with the qualities of the Ferrograph should be looked upon as a long term investment. The Series 3A illustrated here is a high-fidelity instrument and has the following features: Single function switch, bass and treble controls, frequency response at 15" per sec.: 40-15,000 c/s.

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al point. From it, the 3000-ohm tuner supply resistor bridges to nearest the tuner, providing its supply. Lug 8 should be by- back to the earthy lug 2 with an electrolytic.

s 4 and 5 are blank but lug 6 ter- s the AGC lead, running forward the vicinity of the video detector passed also to the earthy lug 2 by mfd tubular capacitor. If a tuner shunt resistor is required, as men- earlier, it can likewise be mount- ween lugs 2 and 6.

-tag strip is adequate for the IF wiring, being mounted alongside the front of the IF strip.

rear lug can be used to terminate elded audio lead running away to lume control, if the strip you use s to be one with the audio output ne front. If the audio output is to- the rear, as in the Q-Plus strips, dio lead can run through to the the chassis.

UPPLY

ngside the audio lug (if used) can positive suppy for the IF strip, t from the heavy-duty dropping and 50mfd bypass, seen near the hoke.

centre lug is earthy, the next a n for the active heater lead and t a junction for the IF AGC lead g forward from the video detector. AGC point can be bypassed also n 0.47mfd capacitor.

e large bypass capacitors on the and IF AGC systems are most ant items. Without them, the nal carrier energy during the block tends to cancel itself through GC system, leading to loss of synch and to picture roll.

-tag strip, mounted alongside the the IF strip accommodates the nd audio wiring.

video lead from the detector attach to the rear lug of the strip way to the 12BY7 grid.

2, alongside it terminates the AGC anning back from the IF strip lug 3 terminates the AGC lead he tuner. Lugs 2 and 3 should assed directly to earth with small capacitors, purely to ensure that GC leads remain "cold" for RF. 4 is "earthy," while the remaining n terminate the audio output lead ie IF strip and support the coupl- l de-emphasis components to the udio lead running around to the control.

UTING COMPONENTS

all this wiring completed, the an be bolted onto its prepared and connecting leads jumpered to its supply tagstrip.

same goes for the IF strip, its points being jumpered to the front and video and audio output to strip at the rear. A short length c. cable must also be prepared ect tuner output to IF strip input. i enough of the braiding to per- active and an earthy connection end.

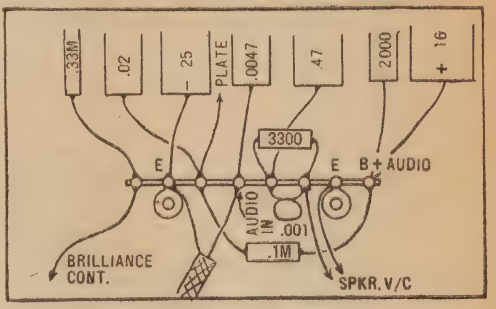
ble types of IF strip were discuss- er in the article but one or two tional points need to be made.

a/ of the earlier prefabricated vere supplied without any video sistor or peaking chokes. Check p you buy and, if necessary, add the components as per our circuit diagram. In the Q-Plus Mark III strip the peaking components are ready built in.

Another point has to do with the AGC problem, discussed earlier.

If you live in an area where signals are strong but not excessive, or if you are disinclined to tamper at the outset with your prefabricated IF strip, then the simplest form of AGC can be used, as in the earlier receivers.

From the video lead, where it attaches to lug 1 on the rear tagstrip, run two miniature 0.22meg. resistors, one to the adjacent lug 2 and the other to lug 3, these being the AGC connections already mentioned. The negative DC potential



A single 8-tag strip, wired as shown will support most of the components to do with the audio system. The other ends of the components, in the main, attach directly to the appropriate 6BM8 socket pins.

generated by the video detector is therefore fed through these resistors to the IF and tuner AGC points, residual video content being eliminated by the bypass capacitors.

By carefully wiring the circuit as described and keeping the resistor pigtails as short as possible, radiation from—and shunting of—the video circuit is kept to a minimum.

If you live in a strong signal area or wish to exploit the dual AGC system explained earlier, wire only one .22meg. resistor to the tagstrip, between the video lug 1 and the IF AGC lug 2.

A.G.C. CIRCUIT

Within the IF strip itself, three additional components are required, which can well be wired as per the accompanying diagram. It is essential to use a miniature coupling capacitor to the AGC diode and miniature resistors, with their leads on the diode side kept just as short as possible. (Note that the coupling capacitor must be a stable variety, not one of the "high-K" ceramics, which could be well in excess of its marked value.)

Long leads may not only introduce enough capacitance to prevent the secondary circuit from peaking but feedback effects may modify the basic behaviour of the strip. Don't try to use bulky components and don't forget that the 6AL5 video diode MUST BE SHIELDED.

Our wiring diagram refers in particular to the Mark III IF strip, which happens to have a vacant lug just where it is most needed. From this lug, the tuner AGC can be jumpered across to the appropriate lug on the adjacent tagstrip. The wiring of other IF strips will have to be arranged on their merits, remembering the basic requirements just listed.

As a matter of interest, we found that the alignment of a typical Q-plus strip could be restored by unscrewing the secondary slug about 4 turns, this just serving to offset the additional circuit capacitance introduced by the AGC components.

Having thus completed the wiring to the tuner and IF strip, the set should be capable of receiving all three television stations. Tuning may seem a little strange and indefinite, but do not worry too much about this. A television receiver is tuned primarily by judging picture quality, the sound more or less looking after itself.

However, if the sound is permanently distorted or has a constant background buzz, irrespective of tuning, the chances are that the overall alignment needs attention.

In fact, this is a rather good time to solve any alignment problems—or have them solved for you—because the chassis is a good deal lighter and more manageable than when all the picture circuits are in position, not to mention the picture tube!

Next month, we plan to complete this description, telling you how to wire in the video and picture tube circuits. If space and time permits, we may be able to give information also on alignment procedure.

(To be continued.)

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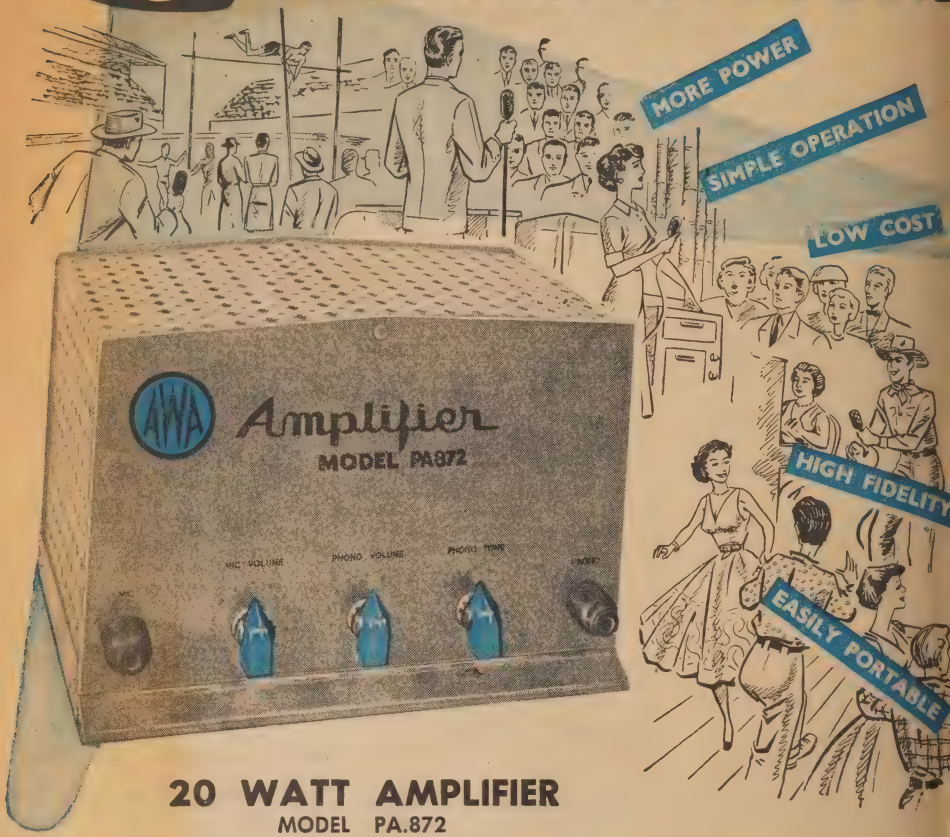

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ANTI-NOISE AERIALS

bject on which very many of nners appear to become tan- is the role of the Anti-Noise al. Here is a brief summary the advantages and limita- of this device, which should ent more being expected it than is reasonable

perhaps unfortunate that these ials have been called "Anti-Static s," particularly in overseas jour- hus creating the impression that, e magical way, they were able to minate against all the unwanted in the atmosphere which we group under the term "static."

, of course, is quite wrong. Such are virtually impossible to elimin- e best we can do being to mini- hem somewhat by such tricks as sing selectivity, the use of noise s, restricting the audio response, where there is a choice, selecting ost favourable frequency channel. n so, "static," like the poor, seems d to be always with us.

where does the "Anti-Static" or Noise" aerial fit in? Is it a myth, s it really help?

, it is no myth, and it certainly elp; but only in certain special In particular, it is directed against oblem of electrical noise which is d to the immediate vicinity of ceiver and aerial.

RCES OF NOISE

liances such as vacuum cleaners, le drills, food mixers, electric etc., can be prolific generators of noise, which is very effectively d by the power mains in the and picked up by the aerial and/ lead-in and fed to the receiver.

if we are able to locate the well away from the noise source, unlikely to be much better off. he lead-in will still have to pass h the noise area, and will pick up ise just as effectively as the aerial. east, an ordinary lead-in will, but type used on our "Anti-Noise" It has a lead-in system designed e virtually no signal pickup of nd, serving merely to convey the from the aerial to the receiver. is done by making the lead-in hat is called a "low impedance A simple transformer at the produces the low impedance out- hile a similar transformer at the r reverses the procedure and pro- high impedance output suitable average receiver.

., we can locate our aerial as far rom power lines and other noise as possible and convey a rela- noise-free signal to the set via our lead-in. In typical cases, the ement can be very considerable. any reader who has such a prob- e would refer him to the July, ssue of "Radio and Hobbies," or supply details through our 2/ service.

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Note:—"T" denotes upper half track, "L" lower half track, all others full track. (Except H4 and EH4, which are half track.)

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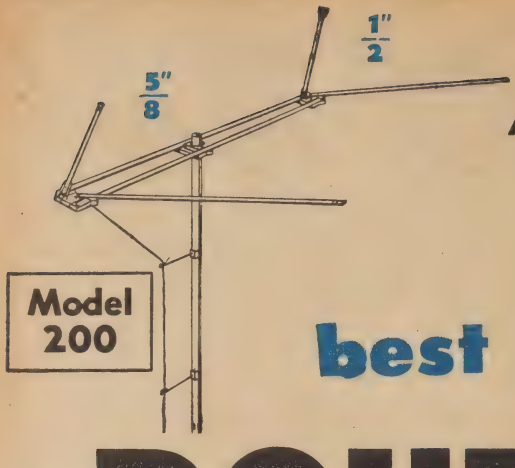

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AUSTRALIA'S AND THE WORLD'S LARGEST TELEVISION AERIAL MANUFACTURERS

Here's your answer, Tom!

ring the month, we received a couple of letters from beginner readers through the nor-l query service. We couldn't take time off to answer the questions fully in the usual way t, by allowing them to take on the anonymity of "Tom", we can satisfy the original enquirers and help other readers at the same time.

No. 1 writes from Earlwood, N.S.W. He says:

ently I was given an old five set which I now want to try to rking but I have come across difficulties.

w is the circuit of the speaker he set had no speaker so I know about it. What size transformer be needed if I used a permag-peaker? If it isn't possible to use agnetic speaker what type should and what size transformer?

o what terminals are what? Is ny simple way of testing the 8 ctroltyic across the plate of the ve and earth? The set uses these 80, 42, 6D6, 6A7 and 6B7. The across the plate and grid of No e was about 680 volts. (No valves n for any measurement).

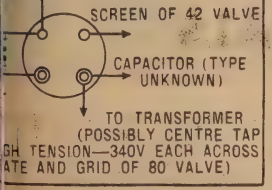
re is a switch which I think is -change switch. Below is the cir- this a wave-change switch?

t possible for you to answer the questions and advise me? I'm I'm only a beginner so there may e mistakes somewhere."

Tom, there are some points "Off m" but perhaps we can straighten tter out sufficiently to enable you nect your set as the designer in-

of all the 8 uF capacitor you t the speaker socket would by-e plate of the 42 to ground. We t probable that you have made ake and that the 8 uF actually s from the screen of the 42 to , (i.e., the opposite pin). If the is wired as you show, then you ly have the destinations of the ires mixed up.

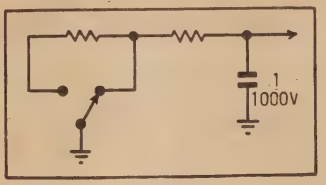
of this era were generally fitted n electromagnetic speaker, the oil having a DC resistance be-


ATE OF 42 VALVE
SCREEN OF 42 VALVE
CAPACITOR (TYPE UNKNOWN)
TO TRANSFORMER (POSSIBLY CENTRE TAP
GH TENSION—340V EACH ACROSS
ATE AND GRID OF 80 VALVE)

Tom's original circuit.

tween about 1,000 ohms and 3,000 ohms. The connections labelled 1 and 4 would be intended to go to the field, while pins 2 and 3 go to the primary of the speaker transformer.

The majority of the sets of this period had the field coil connected between the filament of the rectifier valve and



This is probably the circuit of a "local/distance" switch.

the high tension line. However, there were a few which had the field connected between the transformer centre tap and ground. Your particular set is apparently one of the latter.

A second electrolytic capacitor was nearly always used, connected between the high tension line and the transformer centre tap as shown by the broken lines in our diagram of the probable circuit.

There are some details which we have had to leave out of the circuit because they were subject to variation with different designs. The method of obtaining the bias for the 42 is an example. It could be obtained from a resistor in the cathode circuit of the 42 or from a resistive network utilising some of the voltage drop across the field coil.

Now to answer your specific questions. The 42 valve was normally fed into an output transformer reflecting a load of 7,000 ohms. This load will give the best performance, particularly with regard to the maximum power output.

However, for ordinary listening the load is not really critical and we should say that it could be varied between about 2,500 ohms and 15,000 ohms without making a drastic difference to the sound. The maximum power output would vary with the load and there would be some variation in the degree of distortion for a given output but, since the maximum power output under optimum conditions is about 4 watts and you rarely need more than about ¼ watt in the home, the difference is not of overriding importance in most cases.

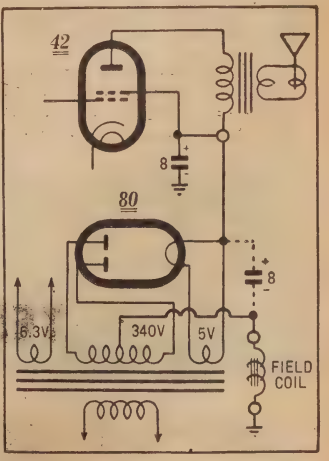
Without knowing more about the set than you have been able to tell us we cannot suggest an exact figure for the resistance of the original field coil. However, considering both the high tension voltage and field dissipation we feel that you would be safe in assuming that it was originally 2,000 ohms.

If you could locate an electromagnetic speaker in reasonably good condition, this would be the most convenient way out of the problem. Many of the console model receivers of the era used 8in speakers and one of these would be very suitable. The power dissipation of the field systems of some of the 5 and 6 inch electromagnetic speakers was limited and a 2,000 ohm field in such a small speaker may overheat.

However, if the resistance of the field is less than 2,000 ohms, the speaker could still be used by connecting an appropriate series resistor. For example, a 1,000 ohm field with a 1,000 ohm series resistor would allow the set to work quite well in the case of a small speaker.

On the other hand a permanent magnet speaker could be used with the set provided a resistor and choke in series are wired in place of the original field coil.

Electrically, the field coil looks like a resistor and an inductor in series. The value of the inductance varies over wide



From the information in Tom's letter, this is a likely arrangement of power supply and output valve.

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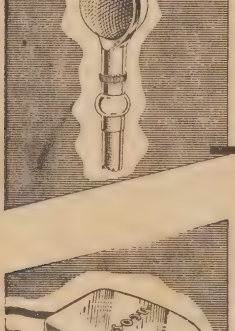
This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost **PRICE, £9/18/6.**



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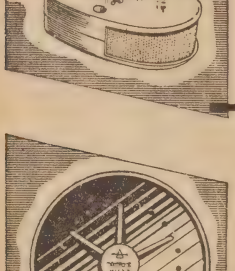
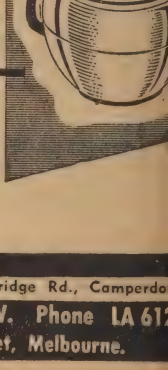


GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**

CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as ⅛ in. square to 1-⅛ in. round, with various thicknesses from ⅛ in. to ⅜ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6**; all others, **£1/19/6.**

(MIC32 illustrated)
(MIC23 illustrated)

Sole Australian Agents:

AMPLION (A'sia) PTY. LTD. 101 Pyrmont Bridge Rd., Camperdo
Sydney, N.S.W. Phone LA 61

Victorian Distributors: DISTRIBUTORS CORPORATION, 403 Bourke Street, Melbourne.

with the particular speaker but would probably be quite safe in ning that it is 10 henries.

e inductive component is needed to hum voltages from the high tension and there is no harm in having inductance than the original, be- it will merely result in better ng—a most desirable state of af-

e inductance of iron cored chokes ases with increasing current drain deally the choke used should main- ts inductance up to about 60 mA the likely total current drain of et. A choke with these specifi- s would probably have a resistance out 500 ohms and therefore the onal resistance you would need to up a total of 2,000 ohms would 500 ohms. It should be rated to ate at least 10 watts and there be an advantage in using a 20 resistor if you have one available.

SPEND MONEY?

inductance would probably be the desirable figure and the wire heavy enough to carry the total er current but, if it works for a nable length of time and the hum is low enough to suit your taste, pend money on a new component! ilar thoughts can be applied to ries resistor. Any series, parallel ries/parallel combination of resis- which gives the required total re- ce and allows each resistor to be ed within its dissipation capabili- in order.

re is no really easy way to check uF capacitor completely. A special ment is needed to check the cap- ce value but you can usually judge is in order by practical results. unlikely that the value will be too but if it happens to be low, the evel will be excessive.

haps more important than the cap- ce value is the leakage of the unit. an be measured fairly easily by ting a multimeter in series with pacitor. For an 8 uF capacitor at 500 to 600 volts working, the e current should not exceed about . Switch the meter to a higher t range to make the first measure- n so that you won't damage the if the capacitor does happen to ulty.

ELECTROLYTICS

acitors in general and electrolytic ors in particular have a definite d in the case of a set of the age one you have, it is most probable e electrolytics, at least, will need ng. There have been big improve- in capacitors in the last few years u will probably be able to buy say, of 16 uF capacitors rated V working which will be smaller pable of providing better filtering he original units.

y of the sets of the same general as yours used a transformer with ondary rated at 385 each side of tre tap rather than 340. The op- field resistance would then prob- higher than 2,000 ohms and it be desirable for the electrolytics, farly the one from the filament of tifier to the transformer centre be rated at 600 volts minimum. ould be advisable to observe all the usual precautions when you switch the set on for the first time with the valves in place. Start by plugging in all the valves except the 80 and make sure that they all light up normally. Switch the set off and then on again with the 80 in place observing that there are no flashes between the plates and filament of the 80 and/or that the plates do not become red hot.

Incidentally, the 80 is a double diode power rectifier, i.e., it does not have a grid. Pins 1 and 4 connect to the filament and pins 2 and 3, one to each plate.

The switch you suggest may be a wave change switch is possibly a "Local/Distance" switch. The automatic volume control system (if fitted at all) in many of the earlier receivers was not capable of handling the wide range of signal strengths encountered. The additional switch permitted the full sensitivity of the receiver to be realised when required for distant stations but reduced the sensitivity when required to prevent overloading on the locals.

Sometimes the switch was connected so as to place extra bias on the mixer and IF amplifier valves but more usually a low resistance was switched between the aerial terminal and ground. Yours could be one of the former type.

PARALLEL CAPACITORS

Continuing with the letter from Tom No 1:

"In your Three Band Three (August '57) it said in the parts list that 3 16uF electrolytic capacitors are needed. Is there any possible way of connecting 6 8uF's to make these up? How are chokes measured? I have one out of an old set and wish to know whether it could be used in the Three Band Three."

Yes, there is a very simple way in which you can make use of your 8uF capacitors. The value of capacitors in parallel is additive so that all you have to do is to connect two 8uF's in parallel to obtain your 16uF. The points to watch are that the two positive terminals are together and that the voltage rating of both units is at least the minimum required by the circuit.

Your question on the choke has been answered in the previous section. If the choke you have will fit, we suggest that you try it in the Three Band Three

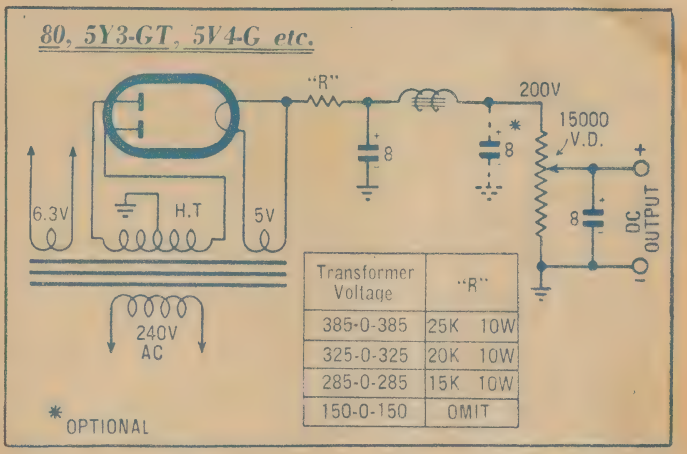
"My knowledge of the technical side of radio is not great yet I would like to build a 3 valve T.R.F. set using a 5Y3-GT as a rectifier. I have this valve together with a 285V transformer, voltage divider etc. from an old B-battery eliminator. Could you inform me if it would be possible to adapt a circuit to use some of these parts in, for example, the Reflex Two in 1951, or the New Babygram?

Yes, Tom, you could probably make use of most of the parts from the eliminator in any one of the sets you mention. The power transformer, rectifier valve, choke, electrolytic capacitors and so on in any AC mains operated receiver are designed to provide two supplies.

One is the low voltage AC to heat the filaments of the valves which is usually obtained from a winding on the power transformer. The most common filament voltage in use these days is 6.3 volts but experimenters may also have need of 2.5 volts, 4 volts and 12.6 volts if they wish to make use of disposals or old valves.

The high tension winding of the power transformer, the rectifier valve, the choke and the electrolytic capacitors are all directed towards providing a smooth direct current supply for application to the plate and screen circuits of other valves.

In the case of many receivers the high tension required is about 250 volts at up to 60 or 80 milliamps, depending on the number of valves. Many will work perfectly well with a much lower high tension voltage and much lower current. In general, receivers with fewer valves require less current.



Here is a power supply which can be built from odd parts. It will provide filament and high tension power for many types of small receivers.

NEW R.C.S. PRE-ALIGNED TV IF's, COILS and STRI

Comb. Video IF and Soundstrip
Part No. 557
£5/15/- plus tax

Comb. Video IF and Soundstrip
Part No. 556
£5/10/- plus tax

3-CHANNEL TUNER
Part No. 553
£3/16/8 plus tax

FOR UNIT WIRING AND TESTING SERVICE PHONE JY1744.

New Square can IF's with internal condensers

Part No.		
112	First video 6AC7	14/-
113	Second video 6AC7	14/-
114	Third video 6AC7	14/-
115	Fourth video 6AC7	14/-
101	Tuner coupling	14/-
102	First video, 6VX6	14/-
103	Second video, 6BX6	14/-
104	Third video, 6BX6	14/-
105	Fourth video, 6BX6	14/-
106	Fifth video, 6BX6	14/-
107	First Sound bifilar	11/6
110	First C.T. Sound	10/6
108	Second Sound bifilar	11/6
111	Second Sound, pri. and sec.	11/6
109	Third Sound ratio detector	18/-

Plus Tax.

FILTER CHOKES AND TRANSFORMERS

Part No.		
55	Power transformers 6.3v 3 amp	20/5
56	Power transformers 12v 1.5 amp	20/5
60	Filter choke 100mA 30h	15/4
66	Filter choke 14h 60mA	10/4
80	2-5v 1.75 amp. 6 kv ins	26/8
61	4v 1 amp. 5 kv ins.	26/8
62	6.3v .6 amp. 5 kv ins.	26/8
63	Frame output trans. 6BM8	33/4
220	EHT supply 3000v Osc. coil	26/8
77	3h. 300mA	20/-
78	1h 300mA	20/-
534	Coil dope and core sealing lacquer	3/-

Coil Former ¾" square can with two cores

Part No.		
506	4-pin coil assembly	4/8
507	4-lug coil assembly inc. 2—47 pf.	7/4
508	5-lug ratio assembly inc. 1—22pf and 1—47pf	7/4

Video and RF chokes filament and filter chokes

Part No.		
408	Aer. RF choke. C.T. 2uh	3/4
409	2uh filament choke	3/4
410	15uh video choke	3/4
411	47uh video choke	3/4
412	150uh video choke	3/4
413	330uh video choke	3/4
414	TV noise filter. 2 amp	3/4
415	3uh damper diode choke	3/4

Plus Tax.

R.C.S. RADIO PTY. LTD.

651 FOREST RD., BEXLEY, N.S.W. LW3491-5385
SOLE FACTORY REPRESENTATIVE — VICTORIA
Distributors Corporation Pty. Ltd.,
403 Bourke Street, Melbourne. MU3908.

COPY OF REPORT RECEIVED FROM THE ELECTRONICS DIVISIO OF SYDNEY'S MAIN TV MANUFACTURER

10th February, 19

MR. BELL,
R.C.S. Radio Pty. Ltd.,
651 Forest Rd.,
BEXLEY, N.S.W.

Dear Mr. Bell,

Referring to the R.C.S. Combined video and sound strip N submitted to us for examination and comment, we found the strip per very well indeed.

When a Philips tuner was connected to it the IF primary (tuner) was adjusted to 32.5Mc/s for a good pass band. The ar kept its pass band shape under varying conditions of bias and strength, which is a clear indication of the absence of feed back No evidence of overload was present even under strong local signa ditions (approx. 250mV from Channel 9). Coupled into a receiv picture quality was good. The pass band of the strip was substantia with a band width of 4.5 Mc/s between the 6dB points. This co well with the best commercial receivers.

With threevolts bias on the A.G.C. line the IF strip showed band sensitivity of 2mV at the first IF grid for 1 volt DC at the diode. With no bias on the A.G.C. line the sensitivity was approx 40uV and the amplifier quite stable.

Built according to the sample described the strip could be u build a receiver of the highest standard of performance to compare ably with any commercial receiver on the market.

NOISE SUPPRESSION

Part No.		Price
19	½amp Line Filter	
20	¾ amp Line Filter	
26	¾amp Line Filter with condensers	
22	5 amp Line Filter with condensers	
24	2 amp Line Filter	
27	2amp Line Filter with condenrers	

Above prices are Retail Prices and inclusive of Sales Tax.

Still the first name in High Fidelity . . .

LEAK

Pick-up with Interchangeable Heads

SPECIFICATIONS:

FREQUENCY RESPONSE: total variation plus or minus 1 db 20,000 c/s to 40 c/s incl. transformer.

LOW FREQUENCY RESONANCE: 20 c/s plus or minus 5 c/s with the very lightweight arm.

HIGH FREQUENCY RESONANCE: on Vynil, 21,000 c/s plus or minus 2,000 c/s 0.0025" radius on shellac, above 27,000 c/s. No grease or rubber is used, and frequency response is independent of temperature.

GENERATING SYSTEM: Dynamic (moving-coil). Coil impedance app. 6 ohms, 1,000 c/s.

PLAYING WEIGHTS: Between 2 and 3 grammes for L.P. Between 5 and 6 grammes for 78. Automatically adjusted by the weight of the head.

STYLUS MATERIAL: Diamond only. Stylus sizes: 0.001" radius plus nothing minus 0.0001" 0.0025" radius plus or minus 0.0001".

RECORD AND STYLUS WEAR: These are lower than on any pickup of which we have cognisance.

OUTPUT: The shielded step-up transformer delivers an output of 11mV for each cm/sec. rms recorded velocity. This means that an amplifier with a sensitivity of 40mV at 1,000 c/s will be easily loaded by the pickup from commercial records.

THE ARM: This is of advanced de having very low inertia. Friction is to a minimum by using a single p bearing. The arm is counterweigh and has provision for plug-in in changeable heads. An arm rest is vided.

DIMENSIONS: From the centre of fixing stem to the front of the pic head, 9¼". From the centre of the fi stem to the rear of the arm, 2". height of the pickup is adjustable it can be used with any turntable.

The motor-board has been cut away to show the simplicity of mounting.

Supplies available from progressive radio retailers

Australian National Distributors: **Simon Gray Pty. Ltd.**

28 ELIZABETH STREET, MELBOURNE, C.1. Telephones MF8211, MF8166

TRADE REVIEWS AND RELEASES

amco Wide-Range utput Transformers

nco now has a full range of fine output transformers for io work, from low-powered le ended circuits to high-power n-pull amplifiers. Illustrated are two of them—one a new-er, and the other a standard best seller.

newcomer is designed for the Mullard 3-watt single-ended ampli- details of which were published by rd in a recent issue.
companion is a larger job intended e 17-watt Playmaster which used output valves.
h are sealed in metal cans with nal boards for external connections hammer-tone finish which is both le and looks well.
cifications for the 17-watt trans- r specify a frequency response 5 cps to 150 Kc., presumably wired he amplifier for which it was de- l, and with virtually no variations. ximum power input is given as 17 at 30 cycles, which is probably the t frequency likely to be concerned such a power.
winding geometry allows for a ection secondary circuit capable of connected for either a 3.75 or 15 termination.
ted in our original 17-watt ampli- his transformer gave very fine re- indeed.
main resonance occurred at a very frequency and required very little itance across the feed-back resistor press it.
adjusted, the frequency response irtually flat to 250 Kc. after which away quite smoothly.
ted on square waves, the amount ging and overshoot observable up to 10 Kc was completely negligible.

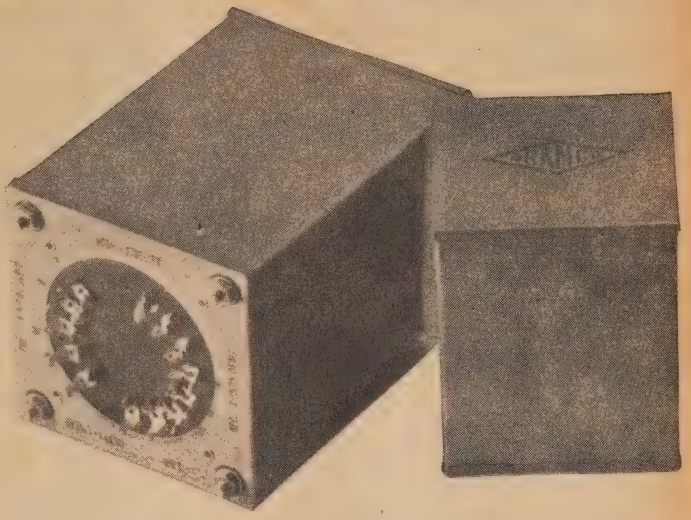
The amplifier was adjusted for 20 db of negative feedback, and with an extra 7 db showed no oscillation.

The power curve as claimed was approximately flat down to 30 cycles. Clean sine-waves were delivered at almost full output up to at least 30 Kc.

Ultra-linear taps are 14 per cent—less than normal and with less drop in stage gain.

It seems obvious, therefore, that this Bramco 17-watt transformer is a leader in its class.

Further details of these and other Bramco products may be obtained from Watkin Wynne Pty. Ltd., 173 Pacific Highway, North Sydney.



Bramco's 17-watt Playmaster output transformer, and a 3-watt model designed for a Mullard amplifier.

W RANGE OF I.R.C. W.W. RESISTORS

recent addition to the extensive ge of IRC resistors is a vitreous mel, fully insulated type, in ngs up to 10 watts.

EATURE of the design is the mooth shape of the resistor body, ing the terminals to be fully pro- by the coating, and the coating to be free from sharp projections may chip and allow moisture to

ree types are available, the RWV4J, 4K, and RWV4L, with commercial s of 4.5, 7.5 and 10 watts respec- . Maximum resistance for each is 4200, 4200, 13,200 ohms respec-

ther details from W. J. McLellan Co. Pty. Ltd., 126 Sussex Street, y.

"DUST BUG" IS NEAT RECORD CLEANER

In an effort to cope with the ever present problem of dust on records, Simon Gray Pty. Ltd. have been distributing an ingenious device called a Dust Bug. As can be seen from the photograph it consists of a nylon brush and a cleaning pad at the business end, both carried on a lightweight plastic arm.

AT the other end of the arm is a base mounted on a rubber suction cup, allowing it to be fastened quickly and simply to the motor board. The length of the arm may be adjusted to suit different turntables.

In use the unit is allowed to track ahead of the pickup, the nylon brush cleaning the individual grooves while the larger pad behind it collects the surface dust. Also supplied is a solution for application to the brushes, and intended to cancel electrostatic charges.

On test the unit proved remarkably effective, and it is quite surprising the amount of dust which can be collected from an apparently "clean" record.

Some motor boards may not take kindly to the suction cup. But without doubt, the Dust Bug does all that is claimed for it.

Further details from the distributors, 28 Elizabeth Street, Melbourne, C.1.

The Dust Bug cleans records by means of a Nylon brush followed by a velvet pad to collect the loose dust. It works fine.

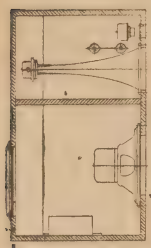
Goodmans

'315' *reproducer*

COMPLETE MULTI-UNIT HI-FI SPEAKER SYSTEM

No compromises whatsoever have been adopted in the design of the Goodmans '315.' Each component is the result of exhaustive development aimed at producing an integrated system which provides the utmost accuracy of high-fidelity sound reproduction. The '315' contains three speaker units: 12" direct radiator type bass unit which operates from 30 c/s to 750 c/s; pressure-type mid-range unit operating from 750 c/s to 5 Kc/s; pressure-type treble unit operating from 5 Kc/s to 16 Kc/s. The mid-range and treble units are provided with variable constant impedance attenuators, externally operated. Network XO 750/5000.

When using the Audium 60 as the bass unit, the reproducer is known as the '315'; when using the Audium 70, the '320'; and when using the Audium 80, the '325'



The enclosure is internally divided into two parts: the upper portion containing the treble and mid-range units and their attenuators; the lower portion containing the bass unit loaded by an Acoustical Resistance Unit in the rear wall of the chamber.

AUDIUM BASS LOUDSPEAKERS

AUDIUM 60

	AUDIUM 60	AUDIUM 70	AUDIUM 80
Flux Density	14,000 GAUSS	17,500 GAUSS	14,500 GAUSS
Bass Resonance	35 c.p.s.	35 c.p.s.	35 c.p.s.
Power Handling Capacity	15 watts	20 watts	25 watts
Impedance at 400 c.p.s.	15 ohms	15 ohms	15 ohms

TREBAX HIGH FREQUENCY PRESSURE UNIT

Frequency Range	2,500 c.p.s. to 16,000 c.p.s.
Impedance	15 ohms at 10 Kc/s
System Power Handling Capacity	25 watts
Crossover Frequency	5 Kc/s

MIDAX MID-RANGE PRESSURE-DRIVEN HORN UNIT

Frequency Range	400 c.p.s. to 8 Kc/s
Impedance	15 ohms at 400 c.p.s.
System Power Handling Capacity	25 watts
Crossover Frequency	750 c.p.s. and 5,000 c.p.s.

Australian Agent:

BRITISH MERCHANDISING PTY. LTD.

Box 3456, G.P.O., SYDNEY

BRITISH MERCHANDISING PTY. LTD
Box 3456, G.P.O., SYDNEY

Please send a copy of GOODMANS "High Fidelity Loudspeaker Manual" to

Name .....

Address .....

..... RH/5/5

ACOS MIC 40 CRYSTAL HAS WIDE USEAGE RANGE

Acos Mic. 40 crystal microphone illustrated here is an extremely d performer for its price, added to which its neat little case oles it to be used equally well in the hand or standing on a table upport. It is particularly good for voice work, and even for music on a modest scale.

average frequency curve given is supplied by the makers and hat most of the output is centred road central band which gives esence.

rently there are no obvious peaks thin this area, as the microphone to be relatively insensitive to k troubles.

is in line with the maker's claim ounced omni-directional response. e curve shows, the useful range about 40 cycles to 6 Kc. Our ere made with a 5 meg load, which conditions voice reproduc- as remarkably good and very

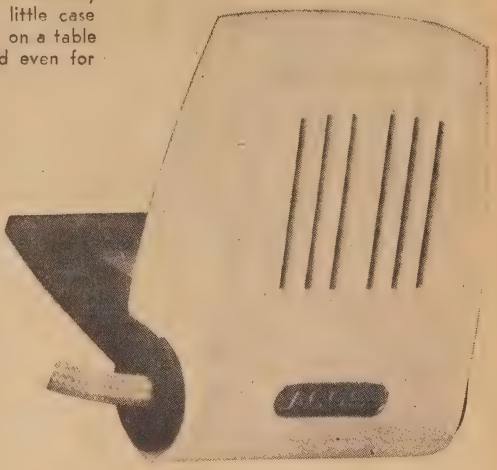
utput level is given as minus 50 l the equivalent capacitance as f.

case comes in two-tone moulded and the little stand folds back contour of the case when not

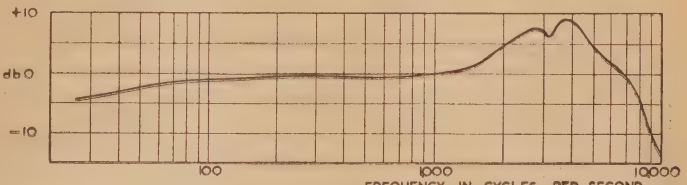
st use would be found in general ork, tape recorders, and other s where the highest quality one is not an essential.

l price is only £3/19/6 and lity is now. Exclusive Austra- stributors are Amplion (A/sia) 1 Pyrmont Bridge Rd., Camper- N.S.W.

☆



Photograph of the new Mic. 40 with the stand opened for desk mounting When not in use, the stand folds back against the microphone body.

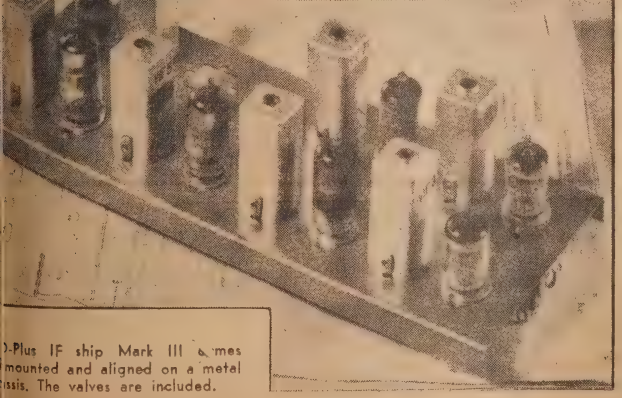


Response curve of the Mic. 40 supplied by Acos.

PRE-ALIGNED Q-PLUS TV STRIP MK3

ST release from Messrs. R. W ne and Co. Pty. Ltd. is the "Q- Mark III prefabricated and pre- IF strip pictured below. It is particularly for use by TV set- , who have no facilities for sub- sequent alignment of their receiver.

The Mark III strip is physically interchangeable with the earlier Mark I, which it supersedes. The circuitry is much the same but the new model uses only two traps instead of three, and bifilar-wound transformers, both measures aimed at simplifying the initial alignment procedure and any rechecking which may be desired.



Q-Plus IF ship Mark III a mes mounted and aligned on a metal ssis. The valves are included.

The ultimate performance figures are substantially the same.

The design provides for four video IF stages and one intercarrier sound stage. Thermionic 6AL5 diodes are used for video and sound detection, one diode element being a spare and therefore available for AGC clamping or for a separate AGC circuit, as in our current 1958 model receiver.

All amplifier stages in the strip illustrated use 6CB6 valves but 6BX6 valves can be used in the same electrical circuit, if 9-pin sockets are used instead of 7-pin.

Normal connection to the tuner is by a short length of coaxial cable, video and audio output points being available from the opposite end of the strip.

The chassis of the Mark III unit is cadmium plated and "passivated," ensuring freedom from corrosion and finger-marking. Being interchangeable with earlier units, it can be mounted directly into the R, T and H television chassis.

It is supplied, completely packaged, with all valves in position and with full electrical specifications. The retail price £27/2/6, including sales tax.

When built into a chassis, it produced good pictures and sound immediately, though an instrument check showed the curve to be affected, as only to be expected, by the setting of the tuner output transformer.

HOMECRAFTS

RADIO IS OUR BUSINESS

100 CLARENCE ST., SYDNEY. BX 4451

RECORD PLAYING

Collaro 3/554 Record Players. 3-speed studio, "O" Cartridge, **£12/15/6**

Collaro R.C. 456 Record Changers, 4-speed studio "O" Cartridge, **£22/7/6**

B.S.R. HF8 Player **£13/5/-**

B.S.R. UA8 Record Changers, 4 speed **£20/10/-**

Collaro Transcription Unit with 16in Arm and PX Head **£31/2/6**

Dual 1004 4-speed Precision Auto Changer **£32/8/6**

COSSOR V.T.V.M. KIT SETS

£29 plus 12½% Sales Tax.

Complete with instruction book, diagrams and printed circuit.

MANUALS

Radio Servicing No. 1 .. .. .. **7/6**
Radio Servicing No. 2 .. .. .. **7/6**
Fault Finding **7/6**
Television Time Base Circuits **7/6**
Television Circuit Refinements **7/6**
The Oscilloscope Book **7/6**
Magnetic Recording Wire and Tape **7/6**

TAPE DECKS
COLLARO MK. III

Four Heads. Twin Track Operation. Switch Mechanism. Pause Control. Tape Measuring & Calibrating Device. Two Motors. High Fidelity. Instantly Reversible. Constant Tape Tension. Retractable Drive. Fully Mechanical. Finish — Cream Polystyrene cover plate with maroon controls. Three speeds.

£52/19/6

SCOPE

SOLDERING IRONS 6 sec.

Standard **£2/10/-**
Instrument **£2/10/-**
Vibroscope **£1/15/-**
Transformers **£2/10/6**

Screw type hole cutters

Complete with wrench

⅞" 7 pin **£1/9/-**
¾" 9 pin **£1/15/-**
1⅛" Octal **£2/18/-**

16-drawer steel Cabinets **£2/8/6**

Q-PLUS CRYSTAL SET

Q Plus Crystal Set complete w Headphones and Aerial .. **£4/19**
Q Plus Crystal Set only .. **£2/13**

CRYSTAL SET BUILDER

Single Gang Condensers .. 1 gui
Q Plus Headphones **£2/**
Spring Terminals 1/2
Germanium Diodes
OA70—OA73 .. .. 6/1
OA81-OA85 .. .. 7/1
Jabel Crystal Coil 8/6
Aerial Wire (100ft) 14/9
Insulators 1/-
Boys' Book of Crystal Sets, 5/-

METAL CABINETS

SET OF 16 DRAWERS

48/6

INVERTERS

Van Ruyten 12TR 12 v DC, 240v AC 100 watt U filtered **£21/8**

Van Ruyten 3253FF 32v D 240v AC 100 watt fully f tered **£31/17**

L ABOUT AUDIO AND HI-FI

'ontinued from Page 53)

nple diffuser can easily be cut a piece of cardboard for test ed in front of the loudspeaker. effect meets with approval, a nt sub-baffle of plywood can be moderate cost.

der to test the effect of the diffuser, discs of aluminium nus—milk bottle tops) were the surface of the cone of an ker, fitted with aluminium voice ive some output even at 15 kc. iscs produced a mighty peak in n the region of 2,000 to 6,000 with a rise of about 10 db, as virtually removed by the slot as shown in Fig. 3.

ll be observed that the effect diffuser is not very severe at ies above 6,000 cps and it is e at frequencies below 2,000. ntally the audio-frequency sig- from an amplifier with almost tput resistance so the cone e in the bass is completely out.

for drop in output at 30 degrees showed an average fall of 6 db 2,000 cycles with no diffuser an average loss of 3 db with In plain language, this means diffuser reduces beam effect and improves the relationship axis and off-axis response.

ne other hand, if you do not be bothered with diffusers, you ays turn the offending speaker face to the wall or pointing this gets rid of beam effects nouflages peaks in response to kable extent because the room work on the sound waves before ch the ear of the listener. are completely averse to beams ks you can fit a diffuser and speaker away or tilt it at a angle.

To be continued.

THE SERVICEMAN WHO TELLS

(Continued from Page 41)

the point, first, where the ion ing became unduly critical and, there was insufficient brightness

!

ng back to a rather more prac- ect of the particular set, I was th the decision whether to leave Q6 in place, or whether there reason why I should obtain a

pared the two sets of data again ar as I could see, there appeared objection to retaining the 6DQ6. its more liberal ratings might a greater margin of safety and t longer life. As if to confirm s, reference to the latest valve ed the 6BQ6 as being no longer ed style.

y. I approached my valve engi- nd again. He did not hesitate to idea his complete approval. he pointed out that it was not to make a blanket recommenda- ce there may be isolated cases ne slightly different physical or l characteristics might prove an ssment.

Do Unseen Powers Direct Our Lives?

ARE the tales of strange human powers false? Can the mysterious feats performed by the mystics of the Orient be explained away as only illusions? Is there an intangible bond with the universe beyond which draws mankind on? Does a mighty Cosmic intelligence from the reaches of space ebb and flow through the deep recesses of the mind, forming a river of wisdom which can carry men and women to the heights of personal achievement?

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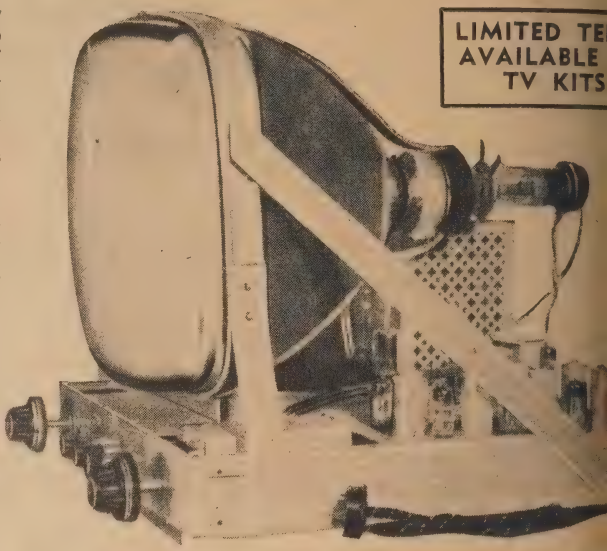

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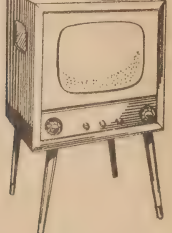

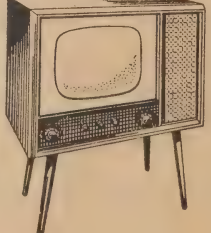

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For those who prefer to buy a ready-made cabin produced three very fine cabinets as illustrated, available in walnut or maple. The cabinet on the extreme left is to the "R. TV and H." design and is available with or without l designed to use an 8in speaker. The cabinet in the centre is also available with or without legs. If desired, two speakers may be used graceful design. The console cabinet on the right—truly a beautiful piece of furniture—will also accommodate two speakers, including those who prefer to make their own cabinets, we can supply plastic picture tube masks, knobs and knob celluloids with station markings TERMS AVAILABLE ON TV KITS.

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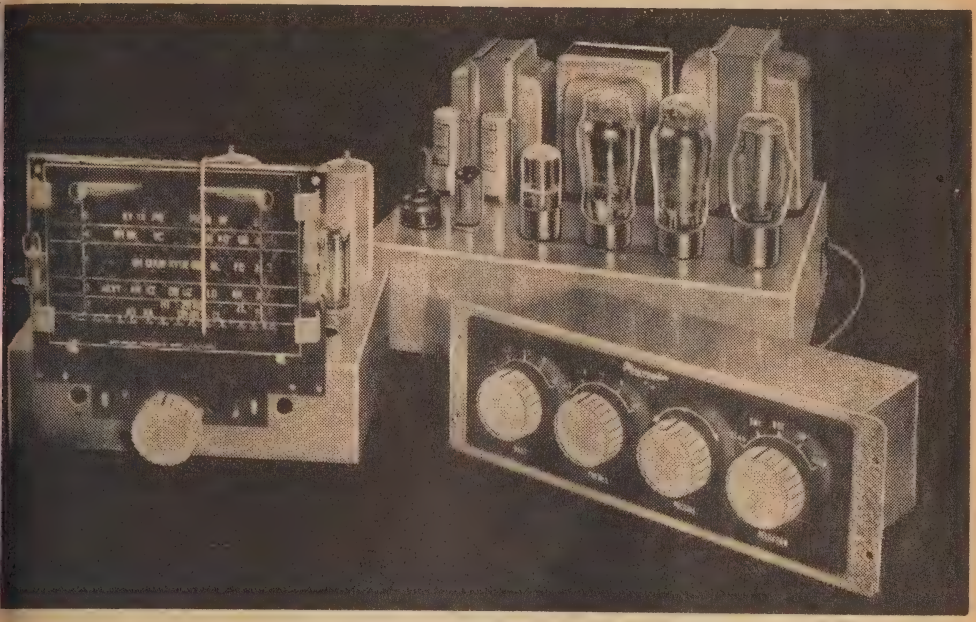

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Type NG 1011

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* Three functions:— automatic record changer — automatic single play — manua single play.

- Push Button operation—Simple and foolproof.
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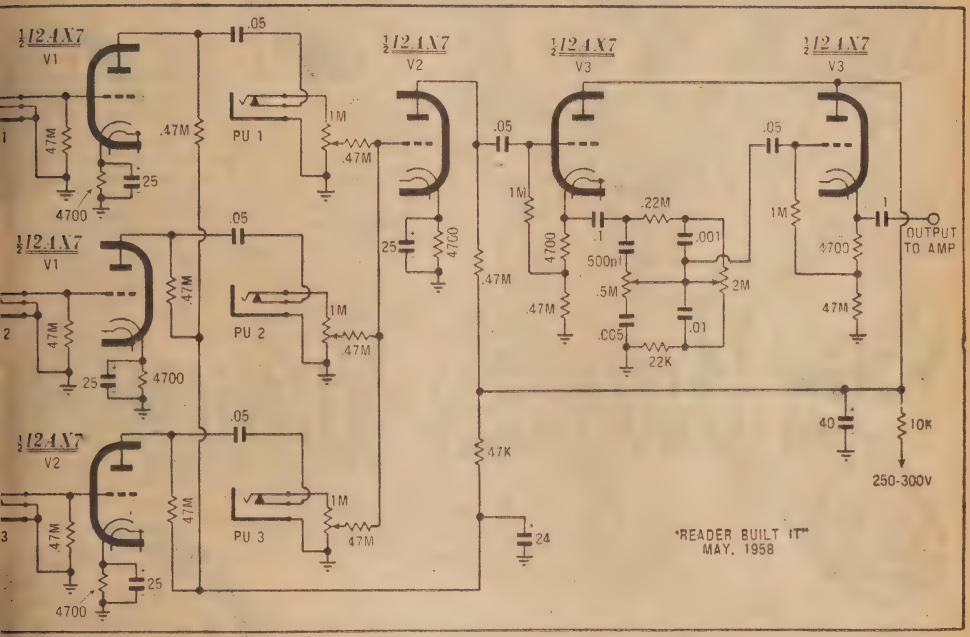
P314

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

EAMPLIFIER—MIXER UNIT USES THREE 12AX7 VALVES



ersatile mixer unit design forwarded by a South Australian reader nits the mixing of three separate channels each of which may be at er low level (i.e., microphone) or intermediate level (ie., pickup). Separate bass and treble tone controls are included.

reader is Mr G. D. Mayman of ackwood, S.A., who says that the the design around the tone con- work has been adapted from an an amplifier design.

Mayman has specified an input ce of 0.47 megohms for the input low level amplifiers. This will be r in many cases but will result loss of bass response when used crystal microphone which re- load of about 5 megohms.

ever, with a grid return resistor egohms, a potential may appear the resistor due to grid current s would prejudice the life of the none if a coupling capacitor is luded. A suitable value would be

12AX7 is suitable for operation id current bias in which case the esistor could be 10 megohms and node of the valve returned direct- round. With this arrangement, the actual load presented to the microphone would be about 5 megs. It has the advantage of using one less component overall per preamplifier and eliminating the bulky 25 uF electrolytic.

The gain of the ½12AX7 triode section will be about 60 times due to the use of the high value load resistor (0.74 meg.). High output devices such as crystal pickups can be fed into any one of the three jacks appearing after the preamplifiers.

From this point the output passes on to a simple mixing system consisting of three potentiometers and three resistors. A moment's reflection will make it obvious that the 0.47 meg resistors connecting with the moving arm of each pot., are necessary in order to allow signals from one channel to pass through the amplifier when one or both of the other pots, are turned fully off. The controls will not be completely independent but the isolation will be good enough for most practical purposes.

Another stage of amplification follows after which a cathode follower feeds the tone control network. Finally, another cathode follower permits the output to be fed to the main amplifier through a shielded lead with small treble loss.

Possible points of criticism about the circuit are that there will be a treble loss due to Miller effect in the triode following the resistive mixer because it is always fed from an appreciable impedance.

CORRECTIONS TO TRANSISTOR RECEIVER

MR O. ANDERSEN makes some points about the transistor circuit which appears in the March issue. He intended that the speaker transformers used as interstage coupling transformers should have a rated primary impedance of 5,000 ohms, not 500 ohms, and also the bias resistor for the TS3 was shown in error as 1.0 meg when it should have been 0.1 meg. Finally he has found that results are best when the secondary winding of the aerial transformer is wound with 5 rather than 10 turns as shown on the circuit.

Let's Buy An Argumen

If I had to nominate a sub-title for this month's offering it would be "Traps For You Players" with these extra words in brackets . . . "And For Old Ones, Too". Oh yes, I fallen into my share of traps but what about yourself?

BY way of example, I wonder if you've ever fallen into this trap, perhaps without realising it?

Say you wished to build an amplifier using a single 6AQ5 valve in the output stage. (For those a little vague about type numbers, the 6AQ5 is a miniature version of the well-known 6V6.)

Accordingly, you seek and find the information you need in a valve data book, probably American by origin or inspiration. It suggests a plate and screen voltage of, say, 250, a grid bias of minus 12.5 and other figures to match.

H.T. VOLTS?

How many volts of filtered H.T. are necessary, assuming the usual cathode bias and forgetting for the moment any drop in the output transformer.

Most people would immediately answer "262.5 volts" and they would be right.

But let's make it a little harder. Let's say we're interested in an amplifier using 6L6 valves in push-pull class AB1.

Referring to a valve data book of the same ilk, we find that the valves can be used with 360 volts on the plate, 270 on the screens and either a fixed bias of minus 22.5 or that provided by a 248-ohm common cathode bias resistor.

Once again, the same question might be asked about total H.T. voltage and with much the same reply. It would be 360 in the case of the fixed bias and 383 for cathode bias, the extra 23 volts being the drop across the bias resistor at the total standing cathode current.

If there are any doubts on this score, three separate circumstances attest to its accuracy, each more positive than the one before.

Firstly, the power output quoted for self-bias is 24.5 watts against 26.5 watts for fixed bias. The two figures would hardly be so close if the supply voltage were to be 360 in each case, resulting in plate and screen potentials of only 337 and 247 respectively for cathode bias operation.

Secondly have a look at the curves.

by **Neville Williams**

For a plate voltage of 337, a voltage of 250 and a bias of m the standing plate current per not more than 30 milliamps, the data lists 44 milliamps pe Clearly, the screen voltage wou to be well over 250 for the plate to achieve the quoted figure.

Last but not least, we can find statements on the matter. Here's official looking one from the RC Handbook:

DEFINITE STATEMENT

"DATUM POINT FOR ELEC POTENTIALS—In the data for a in the Handbook, the values f bias and positive-potential-electro tages are given with reference specified datum point as follow types having filaments heated wi the negative filament terminal i as the datum point to which oth tages are referred. For types hav ments heated with AC, the m (i.e. the centre-tap on the fi transformer secondary, or the m of a resistor shunting the filam taken as the datum point. For having equipotential cathodes in heated, the cathode is taken as the point."

That statement doesn't leave ro any doubt and it sums up A practice and such local practic literature as is based on the A pattern.

In cases like the ones we have all voltages are in respect to the pin. Thus, where cathode bias volved, the bias must be calcula multiplying cathode resistance by ing current, the resultant being to the plate voltage (plus any the load) to ascertain the high supply.

Similarly, the screen must be o above earth by the quoted figu the cathode bias voltage.

Now I can imagine many saying . . . . "Well, what's new that? We've been doing that for

Possibly you have and tha where this trap for not-so-young comes into it.

ALTERNATE TYPES

Let's say you can't buy th when you want them but there ar of EL34's about. The valves a parable in many ways and a gl another very large Data Handbo time European inspired—shows t such valves in push-pull will watts of output.

hely, therefore, you read off the
ed plate voltage of 375, add some-
for drop across the load and then
nother 22½ as the estimated drop
the cathode resistor. The result?
ered H.T. supply of just over 400

ther, you're wrong. Horribly, dan-
sly wrong.
y?
ause it is not universal. Europeans
ice is simply to list electrode-to-cath-
voltages. If read casually, without
ing the method of presentation, a
deal of it is tantamount to listing
es in respect to earth, not cathode!
e a look at the same three sources
idence as previously quoted.
pair of EL34's with fixed bias gives
tts as against 35 watts for the
valves, with the same quoted plate
screen voltages but with cathode
This is a big discrepancy and it
indicates that the effective plate
creen voltages aren't as high in the
ase as the other.

VE CURVES

at have the curves to say? With
olts as the H.T. supply and a 470-
common screen resistor, the screen
ge would be about 364. Fortunately,
are curves available for a 360-volt
n condition. From these curves, the
nt for 375 plate volts and a bias
2.5 is around 100 milliamps per
which is a long way from the
d 75 milliamps.
her the data is wrong or else the
is for a lower screen voltage than
What more logical than to assume
it is for 340 odd volts, representing
upply voltage minus the drop across
specified screen series resistor and
minus the cathode bias potential.
d what have the relevant data books
y? Nothing that I could see in a
check in the way of a bold state-
. However, they do use a system of
ripts indicating electrode voltage
supply voltage, presumably differen-
g between potentials in respect to
de and to earth.
e intention may be good but I'm
oo sure about the execution or the
pretation thereof. I've come across
where Va, meaning anode voltage,
uoted, it being left to the reader
ork out whether cathode voltage
ld be added to this or not. Yet
here, one finds Vab or Vba meaining
e supply voltage or yet another
rent variant "Va plus Vrk."

T TOO CLEAR

"try-out" on a few engineer acquain-
es showed a good deal of uncertainty
t the whole business and even a
e engineer from one of the "relevant"
panies needed time to think about
al instances.
e were able to point out cases where
al operating conditions were based
total supply voltage, including the
across the cathode resistor and
load. Yet comparable ratings for
r valves required the user to add
figures together and work out the
ly voltage for himself, exactly as
American practice!
owever, I have no inclination just
to elaborate on policy or practice
ven express opinions as to which
e better method. I'm only trying
nake the point that you can very

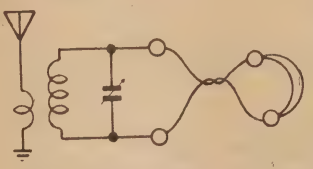
EGAD, SIR! THIS IS TREASON!

Dear Sir,

In your latest issue of your very fine magazine, "Let's buy an argument" mentioned the subject of detection.

There is a point that I would like to raise about this topic and perhaps you may be able to help me out with the answer.

Volume 2 of the Admiralty Handbook, Section "D" 3, mentions the necessity for a detector and gives three reasons why an R/F signal, amplitude modulated by an audio signal, would not be audible if a pair of headphones were connected across a simple tuned circuit, which in turn, was coupled to an aerial.



The following reasons are given in support of the above statement, but I can only agree with two of them.

(a) The diaphragm of a telephone earpiece cannot vibrate at frequencies much beyond the audible range, and at radio-frequencies the diaphragm remains unmoved, indicating that the mean value of the R/F current is zero over any appreciable time in excess of the period of the R/F cycle; any two consecutive half cycles of R/F current are approximately equal, and cancel each other out so far as the telephone diaphragm is concerned.

(b) Even if the diaphragm could vibrate at radio frequencies, the ear could not detect the result since it is above the A/F range.

(c) The high inductance of the earphones would present such a large impedance to the R/F current that its value would be too much reduced.

It is (b) that I cannot agree with. Another way of putting the statement is to say that if we produce a supersonic wave, that is varying in intensity at an audio rate, the human ear would not detect it. But have we not been taught that the human ear has a logarithmic response? Is not the human ear a detector in itself?

If the supersonic waves impinging on the ear drum, were varying in intensity at an audio rate why shouldn't the ear respond to this audio component?

I have mentioned this point to several people and although no one will accept it, they cannot give me a satisfactory reason why the ear would not respond.

Yours truly, K.R.

easily fall face first in the mire, if you don't pick your way very carefully amongst these subscripts with their possible inconsistencies—or their complete absence in what we have called American practice.

But perhaps you have been trapped, without even knowing it. Come now . . . honest?

On the other hand, of course, you may dismiss the whole thing as trivial —just a peg on which to hang a lot of space-filling copy.

If so, you're in even deeper than you think.

Look again at those EL34 ratings, which I quoted. If voltages are accepted as referring to earth, then the ultimate plate-to-cathode volts on the EL34's is 375, minus an "official" 20 volts drop in the output transformer, minus 22.5 volts across the cathode resistor, equals 332.5.

Multiply this figure by 75 milliamps and you find that the plate dissipation with no input signal is right on the maximum rating of 25 watts. There is absolutely nothing to spare.

In fact, if you use a typical Australian output transformer with only about 5 volts drop in each half of the primary, the plate dissipation creeps up to 26 watts.

HIGH DISSIPATION

Go one step further and use the valves with 375 volts plus bias on the plates and only 5 volts drop in the output transformer and the plate dissipation runs to over 29 watts on the score of voltage alone, without taking account of the inevitable and accompanying rise in current. In practice, dissipation would doubtless run to well over 30 watts unless the current were restricted by other means.

If EL34 valves should fail prematurely under these conditions and be returned for replacement, the manufacturer or distributor would have every good reason to deny responsibility.

As I said, you'd be in deeper than you thought.

TV IF STRIPS

So much for valves. Here's another potential trap which I encountered during the month, this time to do with television IF amplifier systems.

I found myself in conflict recently with an engineer type who maintained that it was becoming common practice, especially overseas, to nominate supply voltage and current to television IF strips and tuners under "typical signal input conditions."

As witness of the said fact, I was invited to have a look at service data from this, that and the other organisation; which data, I must confess, was not to hand.

I did have a look, however, at the data which were available and, in every case, the voltage reference table carried a note to the effect "no signal input" or "aerial terminals shorted" or "tuner set to vacant channel."

This is surely the only logical way to measure voltages within the tuner and IF channel. Under these conditions, with no AGC voltage applied, the valves

The World-famous GRAMPIAN 5/10 BU Power Amplifier

Now available with 10mV

High Sensitivity Pre-Amplifier and Control Unit Type 56

A Combination which offers

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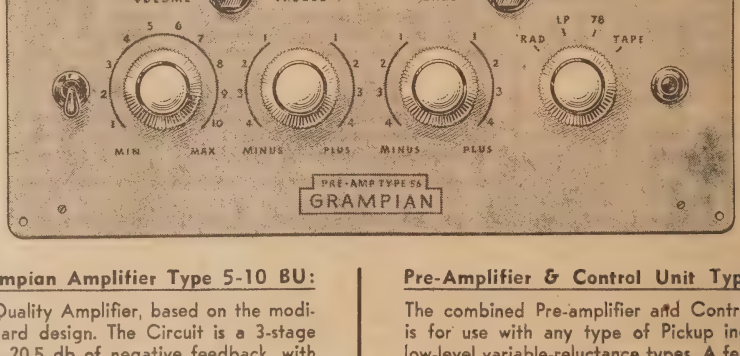

The Grampian Amplifier Type 5-10 BU:

A High Quality Amplifier, based on the modified Mullard design. The Circuit is a 3-stage one, with 20.5 db of negative feedback, with an ultra linear, distributed load outward stage employing 2 pentodes in push-pull The large-sized mains transformer provides ample power for a tuner unit.

Specifications:

Power output, rated: 10 watts
Total Harmonic Distortion: Less than 0.4% at 40 c/s. Less than 0.2% at 400 c/s. Less than 0.3% at 2,000 c/s.
Hum and Noise: -73 db relative to 10 watts
Frequency Response: Plus Minus 0.5 db 10 c/s to 20,000 c/s.
Output Impedance: 15 ohms or 4 ohms.
Supply available to radio unit: H.T. 250 volts 40 m. amps. Heaters 6.3 volts 3 amps.

Pre-Amplifier & Control Unit Type 56:

The combined Pre-amplifier and Control Unit is for use with any type of Pickup including low-level variable-reluctance types. A feedback circuit provides correct compensation for LP and 78 r.p.m. records and also enables the unit to be used with inputs from a radio tuner or tape recorder.

Specifications:

Pickup input: Impedance, 200,000 ohms; sensitivity, 10 mV.
Radio input: Impedance, 100,000 ohms; sensitivity, 100 mV.
Tape input: Impedance, 100,000 ohms; sensitivity, 50 mV.
Tone controls: Bass, +10 db to -8db at 40 c/s; treble, +10 db to -10 db at 10 kc/s.
Power required: 250v 2 m.a. 6.3v 0.5 A.
Valves: 2 EF86.

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ɔe drawing maximum current and discrepancy, either in valve emis- or component valve will be most ent.

fact, it wouldn't be far wrong to st that voltages and currents mea- under any other conditions would eaningless.

"typical input signal" has no ab- value and it could be anybody's what order of AGC voltage it l produce. And, with high-gain cut-off tubes, it doesn't take a big change in AGC volts to pro- a very large swing in the plate screen circuit.

may be helpful to nominate the of AGC voltages produced by through-to-strong input signals, by of a general guide, but to quote figures of voltage or current on ing but "zero signal" conditions or, e very least, some strict figure of ive control voltage would be mis- ig indeed.

CE WAS ENOUGH!

e seen it attempted once only,) prompted the argument in the place. I have no ambition to see ain, unless these remarks can be en wrong.

would constitute a trap indeed, if is any move to follow the al- tendency. So much for trap num- two.

ey say, you know, that confession od for the soul.

ell, here's a confession about a trap h caught me well and truly this h. In a way I'm glad it did, be- e I recognised quite a few people n its confines.

orking on our new TV receiver, red in a new prefabricated IF strip, h had been submitted for test. This , the set was tuned to a station. d it work well?

o, sir, it did not.

ere was plenty of sound and pic- to be sure, and the line circuits ed in fine style. But the frame, just dn't. The hold control was critical ne extreme and the slightest dis- nce threw the picture off synch. fact, it played some rather novel s. Sometimes it would roll, some- stay still with the blanking bar ay up the screen, sometimes lock the blanking bar protruding into op of the picture or sitting squarely he bottom.

GINALLY OKAY

was most intrigued to see the ef- because the receiver had been op- ng normally only minutes before another IF strip in position.

y confrere Phil Watson was simi- intrigued. (Yes, I'll "put him in")

e began to recall that correspon- a few weeks back, who had com- ed of just such an effect; and the who rang the other day. Then was the man whom we talked to nally—all with similar trouble.

rhaps it was due to some quirk lignment? Industriously, therefore, et to work and realigned the strip vith no improvement.

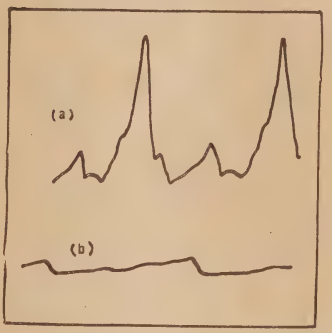
rhaps it was an overloading effect? w strip, too much gain, too much and therefore synch. pulse clipping? e started checking AGC volts and tried reducing the level of the input signal. The AGC was high but not excessive. Reducing the signal input stabilised matters somewhat but not in the way one would expect. No, it wasn't an overload problem.

What of the synch. separator? Had we disturbed the wiring somehow? In other circumstances, we might have been tempted to "start in" on this portion of the circuit, because it could have been a synch. separator fault. But that would have been silly in this case, because the circuit had been satisfactory a few minutes before.

No, it wasn't accidental interference with other wiring.

Well now, dear reader, have you dropped to what the trouble was. You should have. I've described the symptoms

So your "Frame Hold" works poorly!



If the lines in your home-built TV receiver lock well but the frame hold is poor, the chances are that you've fallen into a simple trap. See text.

exactly as they occurred and our threshings around in the "trap."

Come on, what had we overlooked?

Surely, it must be obvious to one as alert as yourself; to one who has never been caught.

It isn't? Well I'll tell you

When installing the new IF strip, we had simply forgotten to add the extra 0.47mfd bypass to its AGC supply line. As a result, we had been trapped into suspecting alignment, overload, synch. separation trouble or even a wiring accident.

To judge by the remarks of the aforesaid readers, they had also been thinking along similar lines, having spent fruitless hours checking and rechecking these quite innocent sections of the circuit.

FOR LITERARY TYPES

Some textbooks use the term Picafarads, spelt with an "a". Most authorities seem to agree on Picofarads, spelt with an "o" Why the difference and who is right, anyway?

I can only say that there is little excuse for their omission — or ours, for that matter. The component was shown in the circuit, mentioned in the text and even made the subject of an oscillogram tracing in a recent instalment of our "Course In Television."

And what does happen when the capacitor is omitted? Well, each time the frame pulse chain comes along, it generates extra AGC bias and drops the gain of the IF system for the same brief period. In other words, the frame pulse tends to cancel itself by its reaction on the AGC system.

To prevent this happening, the AGC system must either be made insensitive to pulse length, as in the keyed circuit, or it must have a long time constant—hence the vital 0.47mfd capacitor.

The accompanying diagram, reprinted from our television course, shows the AGC voltage from a simple system without adequate bypass (a) and with the extra 0.47mfd. in position (b).

CHECK AGC BYPASS

Naturally enough, if one doesn't appreciate the possibility of this happening, a lot of time can be wasted chasing trouble in quite innocent parts of the circuit.

So, if you have any doubts about the frame synch. in your home-built receiver, check up on the AGC bypass, particularly the one which is associated with the IF strip.

How many readers have fallen into this trap?

Finally, may I enter a brief but anguished plea to that very small minority of readers who insist on setting a trap for themselves by ignoring the layout and instructions which we prepare pretty carefully for our projects.

We've come across a couple of woeful examples in the last month of readers too "smart" to follow the prepared design but who, when the project fails, are most critical of the designer, the component manufacturer, the supplier — everyone except themselves!

Nothing to do with traps, but we reprint on the previous page a letter from a reader, who presumes to question something in the Admiralty Handbook. This is a very serious thing to do because, quite apart from the tradition behind it, I have generally found the said handbook to be very reliable, as far as it goes.

But do you know the answer to his query? If you don't, why not stop and think about it?

It will be good mental exercise.

Having done so, I think I can suggest to you the reason why we don't hear RF signals.

It's quite simple, really.

Our ears may have a logarithmic response and be capable of a detecting action—but only within the frequency range where they function.

NO RESPONSE AT ALL!

To radio frequencies, our ears presumably have NO response, therefore there can be no question of a logarithmic function or of detection either.

The circumstance would seem to be paralleled by ordinary electrical detectors which cease to function beyond certain frequency limits by reason of the swamping effects of capacitance, inductance or transit time.

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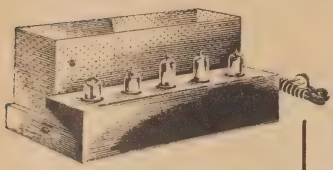

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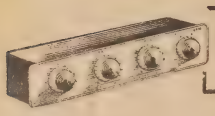
Power output rated at 10W (max. 12-13W). Total harmonic distortion less than 0.4 p.c. at 40 c/s measured for 10W output with normal loading and sine wave input. Frequency response: plus or minus 0.5db. 10 c/s to 20.000 c/s. Valves: 1x EF86 low noise pentode input stage: 1x 12AX7 double triode phase splitter: 2x 6BQ5 pentode push-pull output stage: 1x 6V4 full wave rectifier. Size: 11¾in x 6½in x 6in.



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Incorporates input selector switch for tuner and pick-up, bass and trebie boost and cut controls and volume control (without AC Mains switch) on attractive front panel. Recommended for crystal pickups and tuners only. Pickup input impedance of 1M ohm. Output impedance to main amplifier of 1M ohm. 12in x 3in x 1¾in.

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(for 40mV across volume control at 1 Kc/s). Sensitivity: Tuner 100mV: pickup LP 50mV: pickup 78-60mV all at 100K ohms input impedance. Microphone 10mV at 1M ohm input imped. THD 0.1 p.c. on tuner and pickup: 0.15 p.c. on Mic. Average control of bass plus 18 minus 12db at 30 cps: Treble plus or minus 15db at 10 Kc/s avail. on front controls. Input selector switch and AC Mains switch on vol. comprise remaining controls. Desirable playback characteristics built-in for 33 1-3, 45 and 78. 1 valve: type EF86. Output imped. to amp. 250K ohms. 12in x 3in x 1¾in.

Also AEGIS PRE-AMP. Mark II (for 40mV across col. control at 1 Kc/s. Sensitivity: tuner 30mV. Pickup 2-4mV depending on setting of comp. control, all at 100K ohms input imp. Mike 4mV at 1M ohm input imp.: Tape 30mV at 0.5M ohm input imp Imp. to main amp. 50K ohms THD very low. Bass plus or minus 10 db at 50 cps. Treble plus 12 minus 6db at 10 Kc/s. Choice of three playback characteristic curves. Input selector switch and AC mains switch on vol. control. Two valves: type EF86. Tape playback and record jacks on front panel. Price: £26/15/6.

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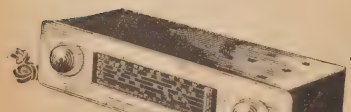

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OFF THE RECORD — NEWS & REVIEWS

ery little more positive news is available on the stereo disc front other than to report continuing interest. Some crystal pick-up manufacturers are talking of early release with a mple and inexpensive unit, and some cartridges are available in the States, varying from igh priced models to cheaper ceramics. But so far activities can only be considered as preliminary and even experimental.

by John Moyle

OM what I hear, we are likely to have some demonstrations in Syd- n about two months' time, mounted rms associated with the recording try, but the year will be far ad- ed before general equipment sales be possible.

one is interested in giving a g impression by publicising stereo n is not of high quality.

the meantime, the information in issue concerning the Westrex cut- head will give a good idea of how ecording problems are handled.

e release of this information is in ast with the silence of the British a firm, which has made records numerous stereo systems, includ- i5/45 cuts.

fact this method was even men- d by Blumlein, of E.M.I., in his reports on stereo as likely to be est of them all. His reasons were same as those which caused its tion today.

it British recording firms are amaz- taciturn in talking about their own evements.

is probably, therefore, that the rex cutter is only one type of head e used by recording companies. it so far it is the only one which been unveiled to an interested in- y.

experimenting with stereo cutters, oncerned have undoubtedly learned eat deal. One of the projected ms involved recording frequencies o 30 Kc.

ne can't make even moderately suc- ful devices of this nature without ng great experience to be profitably nded on more standard techniques.

NTH'S RECORDS

BRUCKNER—Symphony No. 9 D minor. Played by the Con- rtgebouw Orchestra conducted by duard van Beinum. Philips 00390L.

ecordings of this symphony are few, there is therefore little opportunity comparison, nor is it played suf- ntly for most people to be easily liar with it.

is a very long symphony, and, as ted out in the jacket notes (which full and useful), there is a difference pinion as to whether Bruckner in- ed another movement.

is quite probable, for the spirit of nan and the earnestness with which vent about it suggests that a mighty e might have been planned.

n the other hand, Bruckner may, in last years, have found himself un- l to the task.

ery wisely this tremendous musical has been recorded from a sufficient nce to sustain the full effect of er and size.

Some highlighting could have been attempted; for instance, the tympani and brass at the commencement of the second movement might have been given even more contrast with the quiet passages that follow.

There could have been little danger in extending the dynamic range quite a bit.

Apart from this rather hypothetical improvement, I am filled with admiration with the firm and understanding handling of the music by van Beinum and the adequacy of the orchestra. Maybe the Scherzo could have carried more abandon, but at least it does not lack vitality.

In both the first and third movements, the latter so reminiscent of Wagner to whom Bruckner owed much, there are some moving and powerful moments.

Throughout the many long and heavily charged passages there is nearly always a sense of shape and purpose, and this isn't easy in such a very large work.

The only technical flaw is a faint measure of pre-echo now and then. I can't count the split in the second movement as such, for it couldn't be helped in single disc treatment.

The surface is extremely quiet.

★ ★ ★

ELGAR—Violin Concerto in B minor Opus 61. Played by Yehudi Menuhin and the London Symphony Orchestra (recorded 1932) conducted by Sir Edward Elgar. HMV OALP 1456.

Menuhin's early Elgar, recorded 26 years ago, has ever since been considered the finest on records, and even today, transferred with outstanding success to L.P. it still sounds quite well.

Although dubbed from discs, you will be hard put to discover any sign of the breaks between them, either in fractional time lapses or in deterioration in quality.

For a boy of 15 years to handle a work of this type in so masterly a fashion is an indication of his early genius.

Part of its success probably lies in the fact that the music has an ingenuous quality which seems to elude older people. I have heard it played by many leading violinists of today, and none of them has approached the potent appeal of the young Menuhin.

Its historical value, too, is great, in that Elgar himself was the conductor. Certainly he wasn't the world's best, and more than once allows the orchestra to get away from him, but such matters cannot upset the many virtues of the performance.

The present-day listener will be aware of the big strides that have been made in sound balance in a quarter of a century, but can rest assured that in its day it was a superb example.

And you'll be hard to please if after about five minutes you seriously worry about the quality.

I am only one of a vast number who have been waiting for this disc, and if you love this concerto as much as I do you won't hesitate to acquire it with gratitude to all concerned.

★ ★ ★

THE HISTORY OF JAZZ—Volume One, New Orleans Origins; Volume Two, The Turbulent Twenties. Capitol T793-4.

It's a pity there are too many examples in these discs to allow detailed mention, for they form a fascinating and quite important record of jazz development from early beginnings up to Paul Whiteman. There are two more in the series which no doubt will complete the picture up to the present day.

There is no continuity on either disc—the music itself provides that, and some of it will be news to practically every jazz fan.

One classic example is from the Rev. R. A. Daniels, a negro preacher who was also his own pianist and vocalist. Together with his Mt. Zion Church Choir, assisted with rhythm effects from the congregation, he shows how the jazz idiom found its way even into a Sunday service, and, incidentally, how elementary are the origins of jazz, and their emergence through avenues not normally recognised.

Instrumentally these discs are essays in the development of style, and the many vocal examples show the contrasts and parallels of this development with vocal line which has been a feature of music from the earliest times.

I recommend these records, or at least some of them (for obviously the other two will be of similar quality) to any one who is seriously interested in music. It isn't a matter of whether you like jazz or not — its influence and attachments are so fundamental that it's part of musical history.

Incidentally you'll find the comparison in the treatment of the material and its recording one of the most interesting things to be heard.

★ ★ ★

BRAHMS — Symphony No. 1 in C Minor Opus 68. Played by he Vienna Philharmonic Orchestra con-

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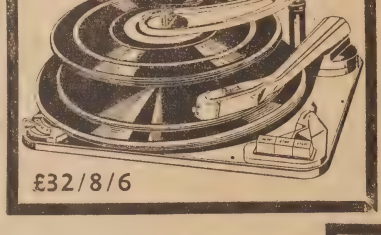

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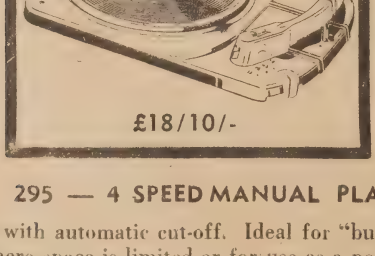

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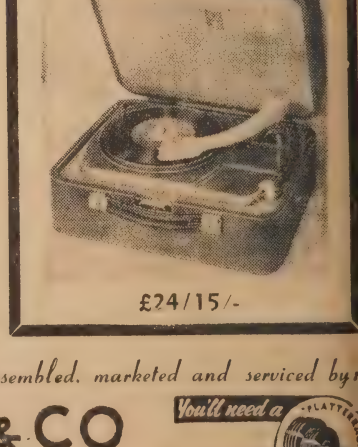

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ed by Josef Krips. Decca
A 5929.

e are too many recordings of this
ony to attempt any comparative
ion. Most of them are very good,
veral would vie for top place with
honours.

newcomer I would place in this
acket.

reason it appeals to me as a very
ty is that it is free from any indio-
sies or attempts to be different.
ning is too fast or too slow, there
surprise packets or things to get
o, the music flows as we feel it
and there is not a note out of

sound has the same character —
forward nor distant, smoothly
ed and with an adequate degree
erberation. It plays beautifully.
night well be chosen as the ver-
ou would like to hear most often.
surface is good.

★ ★ ★

LIERE—Symphony No. 3 in B
or Opus 42 (Ilya Mourometz)
ed by the Berlin R.I.A.S. Sym-
ny Orchestra conducted by
nc Fricsay. DGG LPM 18311.

is a program symphony dealing
he adventures of a mythical Rus-
ero or bogatyr, his mighty deeds
ose of his companions.

hestrally it is full of colour
y and force, and in the original
of considerable length.

this version numerous cuts have
nade, commencing almost from the
ars, which have had the effect of
ng up the movement and accom-
ing the work on two sides.

only other recording I know of
I doubt whether it is still avail-
— is by the Vienna State Opera
stra conducted by Scherchen and
ed by Westminster.

vas, however, complete and took up
sides.

vas also a terrific recording tech-
, despite its earlier date—so much
t Westminster included many pas-
from it in a demonstration record
in U.S.A. And although this new
as DGG's New Look, and is really
good, it cannot match either in
or interpretation Scherchen's

latter's portrayal of the heroes
over the mountains on horseback
y one example in which he is far
successful than Fricsay.

l the thunderous bass, and vivid
mental outlines due to multiple
g, are quite exceptional.

wever, the position is clear—this is
ply the only recording now avail-
and it is still good enough to pro-
for you some striking sound.

a pity that fuller jacket notes were
repared, for the program is quite
t one, and some idea of what goes
really essential. Not only is this
music, but it is important as a
xample of Gliere's work—the last
e traditional old-school Russians
n interesting overlap with the new

★ ★ ★

HAIKOVSKY — Romeo and
et. STRAUSS — Death and
nsfiguration played by the Phil-
nonia Orchestra conducted by
eo Galliera. Columbia 33CX
8.

HAIKOVSKY — Romeo and
et, 1812 Overture, Marche Slav,
riccio Italien. Played by the Pro
ica Symphony Orchestra of

HIGH PRAISE FOR BEETHOVEN SONATAS

BEETHOVEN—Sonata No. 7 in C minor, Opus 30, No. 2; No. 10 in G major, Opus 96. Philips A00412L. Sonata No. 3 in E flat major, Opus 12, No. 2; No. 2 in A major, Opus 12, No. 2; No. 8 in G major, Opus 30, No. 3. Philips A00400L. Played by Haskil (piano) and Arthur Grumiaux (violin).

Violin sonatas have never been a favourite musical exercise with me, even the best of them, and it is, therefore, with mild astonishment that I find myself issuing a five-star award to one of them.

And the other is so close to it that it doesn't much matter.

These two win high praise entirely on their own merits, musically and technically.

Violin sonatas, particularly by Beethoven, require more than usual competence and team work on the part of the participants, and this is the first point which will strike you.

Arthur Grumiaux has already made a good impression in some earlier recordings, and here, under particularly keen microphone scrutiny, his tone, intonation, and satisfying knowledge of what he is about, are of high quality.

And Clara Haskil in some ways is even more impressive.

She is certainly no shy violet, as one might expect of the weaker sex, and one often experiences in sonata pianists

One of the most beautiful examples of a piano part being handled as it should be, not only when it is in the lead, but also balanced against the violin, is heard in the first movement of the Opus 96.

It would be hard to imagine a better performance, and it is because of such work that I have picked this disc for top honours.

The clarity and balance of the parts is not only a happy matter of the average weight of the two collaborators, but it is shared by the recording engineers.

They have solved quite admirably the problem of restraining the sharper violin tone and avoiding a muddied piano in the process, or one which fades back into a hall echo.

As it is, the reverberation constants give life to the sound, and, at the same time, bind it together. In a room of reasonable size, its sense of presence is remarkably well placed.

The surface is so quiet that there is no impression of mechanical reproduction at all, nor is there any hint of distortion. This is first-class engineering and record-making, and first-class music, too. What more can anyone ask of a record?

A quick ear will note a subtle change in the sound of some movements as against others, indicating different recording sessions, but this could hardly stand as even a grey mark, for each section is consistent in itself.

Vienna conducted by Jonel Perlea. Vox APL-8700.

These are grouped merely because the music falls into the same general bracket, and in one instance overlaps.

Without doubt the Columbia has the most glamorous sound, and is, in fact, a very good example of the Philharmonia and its work. I imagine it could play both these items in its sleep by now, not that it sounds that way here.

It is, on the contrary very much alive and you need have no doubts as to the quality of either side.

The Vox is remarkable more for the generous helping of four of the composer's most popular works, over 32 minutes on one side and 31 on the other.

That's really piling it in.

The sound suffers some compression to do this, which has reduced the dynamic range quite a bit.

But it still makes a brave show and all things considered I would not discount it too seriously for that.

After all, you'd have to buy a number of discs to get these numbers elsewhere.

And Vox does this kind of thing as well as anybody.

★ ★ ★

MOZART — Twelve German Dances. BEETHOVEN — Twelve German Dances. Played by the Pro Musica Orchestra, Stuttgart, conducted by Edouard van Remoortel. Vox APL-10,100.

The recording of the Mozart is clean and well articulated, although it is noticeably light in the bass.

This impression would well be countered by pointing out that the orchestra is a small one, and that the dances were intended as light entertainment in which any attempt to build them up in the recording might be out of place.

The miking is not close, but the small hall atmosphere that results is quite pleasant to hear.

I liked the general quality of the Beethoven better than the Mozart, and its rounder tone seems to be more a matter of recording balance than scoring.

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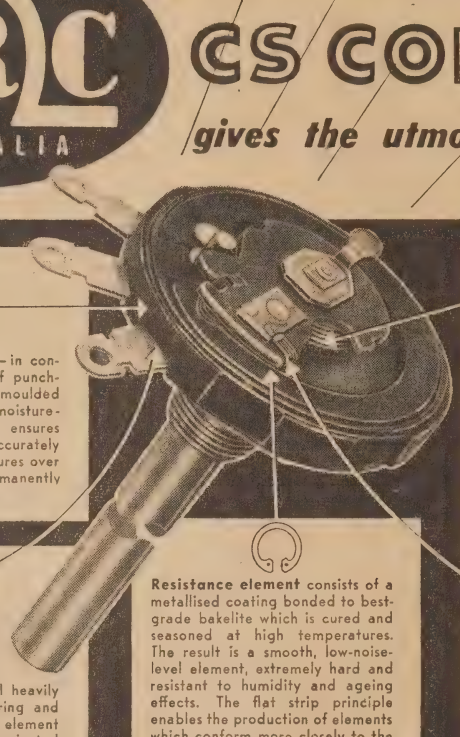

The IRC control base — in contrast to ordinary bases of punching bakelite—is precision-moulded of high-strength, low-moisture-absorption bakelite. This ensures that other parts remain accurately aligned and correct pressures over the entire element are permanently maintained.

Terminating lugs are all heavily plated for ease of soldering and positive connection to the element is ensured by riveting. The riveted lugs, unlike pressure-contact types, will not loosen with soldering and the terminals may be bent for wiring to any convenient position without the control becoming noisy.

Resistance element consists of a metallised coating bonded to best-grade bakelite which is cured and seasoned at high temperatures. The result is a smooth, low-noise-level element, extremely hard and resistant to humidity and ageing effects. The flat strip principle enables the production of elements which conform more closely to the eight published curves than is possible with solid carbon tracks. By virtue of the physical size, the CS element therefore has a greater power dissipation with lower temperature rise than with other types.

The silent spiral is the greatest single advance in volume control design the industry has known. This patented feature **is exclusive to IRC** and it provides for permanently noiseless low-resistance connection between the contact fingers as they move over the element and the centre terminal. The spiral replaces the conventional collector-ring method of connection which has been found to be the main generating source of rotational noise in other controls, due to the oxidisation of the moving metal contact surfaces.

Multiple finger contactor consists of five silver-plated phosphor-bronze springs which are independent of each other and have a "knee action" effect as they move over the element surface. The contact pressure of each spring is accurately adjusted to give correct pressure on the element for minimum noise level consistent with long life

IRC CS controls are available in all standard values and tapers in plain, tapped, ganged and dual concentric combinations with or without DPST or SPST switches.

The IRC CS control is the result of over thirty years' volume control research and production "know how." It incorporates all the best time-tested volume control features known to the industry, many of which cannot be applied to miniature type controls because of lack of space

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standing all-round quality makes this record a musical and technical treat. It is a fine example of balance in modern technique.

[AIKOVSKY — Swan Lake Bal- is 20. Played by the Philadelphia tra, conducted by Eugene Orman- oronet KLC 632.

of the best orchestral recordings ong time.

s also the most stunning Swan yet issued, and this includes the iking Mercury discs, which, how- are unique in that they contain mplete ballet.

is the more or less conventional

on't mean to decry the Mer- ecords, but to their outstandingly inge and dynamics the Philadel- have added a roundness, the re- f carefully controlled reverbera- nd even better balance.

n very pleased to see this use of acoustics coming into fashion it probably went out because it ard to handle.

I listened, I marvelled more and at the beautiful definition of in- nts, and the quality of the play- /hich is quite marvellous in its on and dexterity.

speed and accuracy of the violins opening section is a case in point. her the Minneapolis nor the Phil- harmonia, which presents the Suite for Columbia under Robert Irving, can match them.

But I would soon run out of space if I attempted to elaborate all the mir acles of texture and sheen achieved by the string section, the deep, clean basses, the hard, shock-producing tympani, the delicate harp-coloured passages and vivid solos, and so on.

Far better that you mount it on your own turntable and stand clear!

The Philadelphia Orchestra is always at its best in show pieces of this kind, not that this is just another demo. record.

There are few points of criticism. One concerns the appearance of a noise background on quiet passages — mighty like traffic noises in the hall, the rever beration of which has been used in masterly fashion to give spaciousness to the sound.

Another concerns the violin solos which are not always as well done as they should be.

But neither of these things can disqualify it for the five stars, which I offer in recognition of outstanding all-round quality.

---

vould seem that the sides were at different sessions.

the whole, it is a neat and anly performance, which is a good as records of this music are not to be numerous.

conductor is a newcomer to me ill soon be heard out here in some ant concerts.

cutting amplitude is average, but ar perfect surface makes this an ortant matter.

★ ★ ★

RAVINSKY — The Firebird Ballet No. 1. Played by the Danish al Orchestra of the State Radio cted by Erik Tuxon. World d Club S2.

ermet is getting a good mention nonth, for again he produces the is competitor.

s recorded quality isn't as glam- but it doesn't have to be to e good value for the money, al- Ansermet uses only one 12-inch

nition isn't as good in many places, his does detract from brilliance. 's soloists have better presence, ne climaxes have greater tension. erwise the score is quite a good The orchestra handles the atmos- very well, equally at home in the lt Dance of the Firebird as in the ise.

surface is of good quality, and than Decca's.

★ ★ ★

RIMSKY - KORSAKOV — eherezade. Played by the Radio- phony Orchestra of Berlin con- ted by Ferenc Fricsay. DGG M 19075.

s is one of the best quality DGG's e heard to date.

il recently, records under this have been remarkable for many virtues of smoothness and careful production, but were rarely competitors in matters of wide frequency and dynamic range.

But without prejudice to their original virtues, many discs DGG's now being issued rival the best efforts of other labels with a new sense of realism and presence.

It was interesting to compare this disc with Ansermet's version for Decca, a particularly brilliant piece of work.

The new record isn't as forward as Ansermet's nor as spectacular from a wide range viewpoint. The Berlin players are recorded more distantly, as is general custom, and the high-lights not as strong ly stated.

My interest lies not so much in their differences as in the fact that they should be so alike in their general fine qualities.

For a performance almost purely concert hall in character the new DGG is an excellent example.

Balance is the keynote, and this applies to all aspects of the sound.

Such highly coloured music gains greatly from the right amount of reverberation, and in this respect it is better than Ansermet's.

It is better, too, in its surface quality, which is almost completely noiseless. Unfortunately the wide dynamic range has called for pronounced variable grooving, and some pre-echo has resulted.

Nevertheless it is an issue of very high class.

★ ★ ★

BEETHOVEN — Quartet No. 15 in A minor Opus 132. Played by the Hungarian Quartet. Columbia 330CX 1460.

The Hungarians are nearing the end of the Beethoven series—a mighty piece of work.

I like them in these later quartets best of all. It's not much use hammer-

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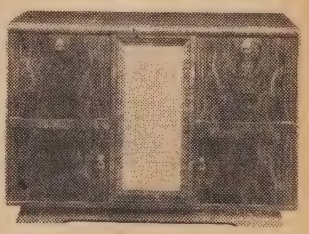

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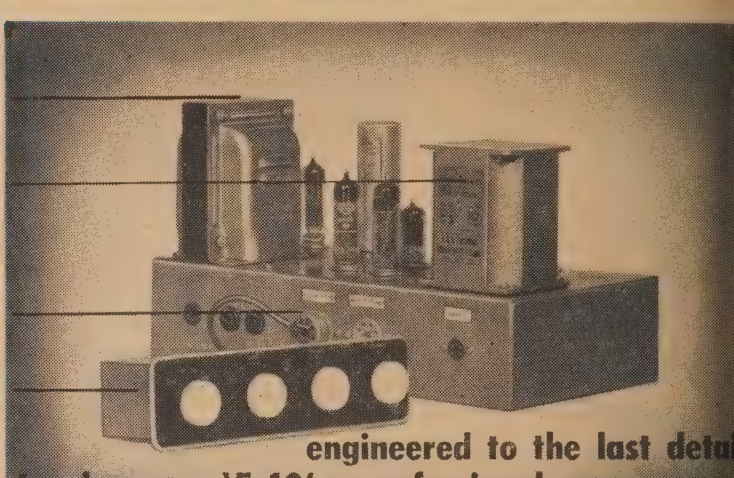

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ray at their refusal to dally by
tyside—their style is direct, con-
nd forward, and you either get
o it or you don't.
ave the feeling that the Hun-
believe, that mental processes
peeded up since Beethoven's day.
ver we have had more time to
the music, and should now be
for a restatement in a modern
nance, rather than a music lesson.
I think, is a perfectly defens-
sition, particularly for those who
pent some time with these quart-
believe, too, that you can't really
th this type of music unless you
t according to your own fashion,
you do so, your ideas about it
o tighten up rather than other-

Hungarians are too good music-
ot to have rationalised their ideas
such lines, and I recognise it
when, as in some of the earlier
s, I don't completely like it.
is a beautiful record, and one of
ost successful in the series. I'll
tempt to assess it in detail. Not
s the music extremely difficult to
about in such a way, but no one
akes it seriously will need my
s.
ay be the only recording available
present time, and it certainly must
of the most distinguished.
nically it is similar to its com-
s, which were all good, some-
reverberant in a manner which
well with the performance.
class.

★ ★ ★

**CHUBERT—Quintet in A major
piano and strings, Opus 114
e Trout). Played by the Buda-
String Quartet with Mieczyslav
szowski (piano) and George
eux (bass). Coronet KLC648.**

ave always found it a little hard
derstand why Schubert added a
bass to this combination, particu-
as there was a 'cello already in
ance.
arently the man who balanced this
ing had no such doubts, for it is
ible not to comment on the ex-
y heavy hand he has allowed it.
power of a double bass is quite
ning at close quarters when a de-
ed man sets about exciting a cun-
designed wooden box about as
the average vented enclosure.
tunately he is not at it all the time,
hen he is he succeeds in exposing
ct that close miking of a double
more interesting technically than
lly.
rt from this criticism of balance
ght this a very pleasant record,
robably the best available in a
thin field, most of which is now
cient to be serious competition.

★ ★ ★

**INU LIPATTI—Barcarolle in F
p major, Opus 60 (Chopin),
orada del Gracioso (Ravel), Jesu,
of Man's Desiring (Bach), Sici-
a (Bach), Chorale Prelude
ch), Sonata in E major, Sonata
D minor (Pastorale) (Scarlatti).
umbia 330CX 1386.**

as most gratefully surprised by
ery good quality of this record.
died in December, 1950, so that
ese performances took place at
ome months before that date.
ening carefully I thought I could
signs of some "work" on them—
the appearance of a faint hum in a few of the shorter pieces may have been due to some extra lift in the bottom register, and some background noise varying at a 78 r.p.m. may have come from discs during a dubbing process.

In the case of the Scarlatti this is almost certainly so.

The smaller pieces are by contrast little more than support for the Chopin and Ravel which take up a single side.

The Barcarolle can only be described as a "memorable performance," for in truth we don't hear it played like this today. I was surprised at the power which comes through in the recording, for so much of Lipatti's playing isn't remarkable for its strength.

We can be grateful for any record of such a fine and musicainly performer, particularly when at least some of the items are of this quality.

★ ★ ★

SCHUBERT—Trio in B flat major, Opus 99. Played by Alexander Schneider (violin), Pablo Casals ('cello), and Eugene Istomin (piano). Coronet KLC589.

This is such a beautiful work that it must delight you whenever played by a good combination unless they deliberately set out to wreck it.

This was quite surely furthest from the minds of these three, particularly in the presence of Casals, who is something of a musical legend these days.

I was particularly pleased to note that he is in good form on this occasion, for he is now an old man, and some other records made at this or a similar session have tended to accentuate this fact.

His musicianship dominates the performance, even if all his old deftness and sure tone isn't fully realised.

I sensed an air of carefulness in the general tempo which may be responsible for some scrappiness in sections such as the end of the first movement, in which perfect timing and cohesion are so difficult to manage.

Then again in the second movement, following the introductory 'cello part, neither the players nor their instruments succeed in building complete unity of sound.

The recordnig may contribute something to this, for even in its era it cannot be classed as outstanding.

One must be honest about these matters, even when, as now, I would like to be more generous about a record which has a special value not only for its own sake but for the conditions under which it was made.

And because, even if it isn't technically remarkable, it contains some very lovely moments

★ ★ ★

SCHUBERT—Quartet in D minor (Death and the Maiden). Played by the Amadeus Quartet. H.M.V. OALP 1088.

I was sure I could find several previous recordings of this work in my files, but the only other disc was an early one by Westminster and the Vienna Konzerthaus Quartet.

It's strange that there are not more of them, unless it is because of the public's lamentable calmness toward chamber music. Otherwise I'm sure we would have plenty.

The Amadeus handles the music much more briskly than the Vienna, and I think it gains thereby. I don't mean that it displays any lack of sympathy, rather that it doesn't spare more than it considers is due.

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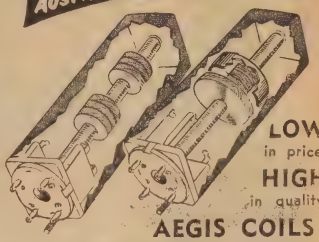

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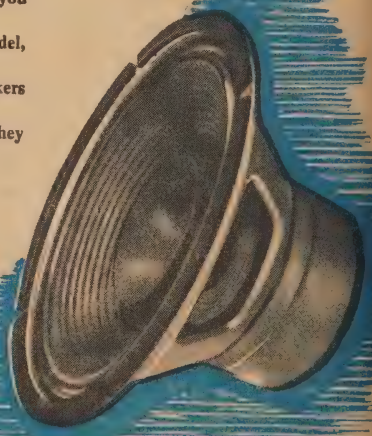

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referring particularly to the movement, naturally, for from quartet gets its name.
ed the way the interest curve was as the variations progressed, and teworthy avoidance of lumpiness can so easily beset the lower in some of them.
nically it is typical of good averndard, but it is not as vivid as estminster disc by a long way. abel excelled in chamber music. irs was an extremely good one. the new record must be pre- if only because it has a quiet —an absolute must for chamber

so, if you haven't much choice, ct needn't worry you.

★ ★ ★

AYDN—Quartet No. 77 in C or, Opus 76, No. 3 (Emperor); TANA—Quartet No. 1 in E or. Played by the Koekert rtet. DGG LPM 18326.

Haydn I think has been issued on a single disc in the days when n't so important to get as much on a record as seems preferable

, I doubt whether there has been preciable loss in the process of ng, as by its nature the groove udes are not high. On the other it is always possible that the t has fooled me by rerecording, don't think so.
ll events, the sound is very smooth , not really forward and even a n dull when judged by the rare les of the best.
the balance is fine, and the com- silent surface helps greatly in pre- the impression of immediacy you can't miss.
, too, is the Koekert's firm hand- the music, its strong and authori- outlines, its freedom from brain . I don't think you'll ever hear er version of the Haydn.
the Smetana, the drama it conseems to bring out the best of the s. They are not so good in lighter nts, such as those of the second nent. Maybe Smetana's hand was heavy in its reminiscences, but I heard more gaiety on other occa-

recording, too, seemed less im- ve than in the Haydn, and not so alanced.

★ ★ ★

EETHOVEN—Symphony No. 3 E flat major, played by the Concertgebouw Orchestra, conducted by ch Kleiber. Decca LXTA 5215.

s is a re-issue of one of Decca's successes, first published about and obviously recut for the purwith all the improvements one expect.
vertheless it has the Decca stamp e period in which the top end was asised largely as a matter of micro- placement. In this respect it is ntithesis of the DGG recording of erlin Philharmonic Orchestra under m issued a few months ago.
er ideas of balance might suggest se of the EMI playback curve, as with good equipment there is a eriness which we don't hear today. odwind and brass particularly have quality. But fortunately there is ck of bass to balance it out, alh instrumental clarity isn't as good e modern Deccas when pressure is ed.

The performance in general is very fine in a forceful, rugged style, not as profoundly felt as Klemperer's version, but memorable nevertheless for its mighty stature.

Kleiber is, of course, dead now, and the re-issue is valuable as a fine example of his best work. As such it has a place in recording archives.

The second movement is particularly powerful and moving. If your ear is quick you will pick some noticeable tape joins in the last movement through the cessation of reverberation for a fraction of a second at each break.

I still class this as one of the best and most vital Eroicas.

★ ★ ★

TCHAIKOWSKY — Symphony No. 5 in E minor Opus 64. Played by the Philharmonic Symphony Orchestra of New York conducted by Dimitri Mitropoulos. Coronet KLC 655.

This is a remarkably fine record technically, and a most impressive dramatic picture of the symphony.

Mitropoulos has really gone to town on the emotions, reasonably permissible with Tchaikowsky, but likely to pall on anyone who knows the music well, and has passed through the stage in which each heavily laden passage is fair game for the wringer.

To my mind, therefore, it cannot equal either the Karajan effort for Columbia or the fine Leningrad orchestra on DGG, for in their way, each of these is every bit as good sonically.

Which makes a nice, uncomplicated choice for you. Plenty of people will pick Mitropoulos.

Incidentally there is an extremely effective photograph of the conductor on the front of the jacket.

★ ★ ★

SCHUMANN — Symphonic Etudes Opus 13; Kreisleriana Opus 16. Played by Wilhelm Kempf. DGG LPEM 19077.

The only real competitor is Geza Anda. I haven't his disc by me for comparison, but as I remember he was much more enterprising than Kempf.

To tell the truth, both these works are rather patchy in quality and interest, and it is normal to find that virtually every pianist is more at home in some sections than in others.

The same can be said of other Schumann works such as Carnaval, the most successful of all in this form.

Perhaps that is why pianists find them so challenging, for most of them seem to play them sooner or later.

Kempf is much more occupied with examination—sometimes cursory—and always with shape and line.

There are some particularly good examples in Kreisleriana (nothing to do with the violinist!) of his ability to join continuity with contrast.

But others have seen more vigor and vitality—even at the end of the Studies, Kempf declines the opportunity to build up his tone.

Nevertheless I think this is a disc that will wear well, even without the exuberance we might like in the better known high spots.

DGG's traditional piano tone is heard neither close nor distant, but very clear and separate, even in the quietest passages, all unmarred by any surface noise.

On all standards, a good disc.

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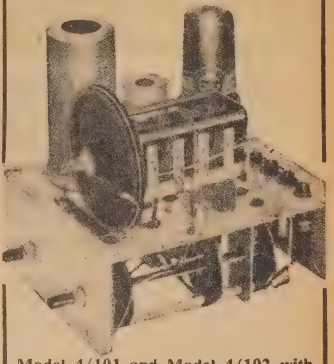

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SHORT-WAVE NOTES BY ART CUSHEN

WINDWARD ISLAND BACK ON 16 METRES

The low-powered station of the Windward Island Broadcasting Service has been heard on 17910 Kc in the mornings.

THE Windward Island Broadcasting Service operates from St. Georges in Grenada and the transmitter on 17910 Kc uses only 250 watts. The station was heard in March with cricket relays when the Pakistan team was playing the West Indies, from before 7 a.m. to 7.15 a.m. Then followed a program summary for the rest of the evening broadcast, and music until 8.15 a.m. when the station left the air.

The announcements indicated that the 16-metre station was for Windward Island students abroad and that a service for local listeners was being broadcast on medium wave and on 5.01 Mc to 8.30 a.m. (6.30 p.m. in the Windward Islands) after which a frequency change was made to 3.365 Mc. The program continued on that frequency, signing off at 10.15 p.m. in the Windward Islands (12.15 p.m. here).

The station was first heard on 17800 Kc in the 16-metre band in 1956, and later verified with a blue card with large letters W.I.B.S. across the centre. It was further heard last winter, at 8 p.m. on 4760 Kc, with an early commentary on the cricket Tests in England when the M.C.C. was playing the West Indies. This commentary was rebroadcast from the B.B.C.

The station uses 5 kw on 3365 Kc, with a four-element omnidirectional beam, while on 16 metres the power is 250 watts and the antenna a half-wave dipole.

LATIN AMERICA CORNER

STATIONS in Latin America in the late evenings, and in New Zealand in the afternoon, are again being heard at the usual winter conditions. Some of the best signals include: CE200 (12.000 Nacional Agricultura, Santiago opening at 9.30 p.m. and closing at 2.10 p.m.; 4VC (9545), Radio Commerce at Haiti, opening in French at 9 p.m; HI2T (9735) and HI4T (5970) both at 8.45 p.m.; Peruvians OAX4W (9415) and OAX4V (5990) Radio America, Lima both heard from 9 p.m.; TIFC (9645) Lighthouse of the Caribbean, San Jose at 10 p.m. in Spanish, also heard closing at 3 p.m. with English gospel broadcasts. Brazilians are numerous from 7 p.m. onwards. Best signals are on 5965, 5975 from 8 p.m., 9545, 9645, 9720, and 9695 from 8.05 p.m. Uruguayan stations are CXA60 on 15385 with English at 6.30 a.m. and CXA2 6000 Kc at 8 p.m.

RADIO EURAFRIC

TANGIER is the site of Radio Eurafrica, a commercial station which has been heard by Australian listeners on 9275 Kc, with programs following the closing of the broadcasts of I.B.R.A. Radio.

This commercial station is one of the many which has programs carried by the transmitters of Radio Africa or Radio Tangier, and although not another station, it appears that the program time is leased from either of these two stations for transmission to the commercial interested audiences of Europe.

Listeners will recall in the past few months such broadcasts as IBRA Radio, DUX Radio, Norge Radio, Danish Radio, WTAN, and now Eurafrica, all with the aims of giving a commercial service in various languages for listeners in Europe.

BENGHAZI INTERFERENCE

RATHER severe interference is being experienced by the new Benghazi station on 7180 Kc, according to a report from Deutche Welle broadcasts.

Abdul Hamid, Muffaid, Director of Post and Telecommunications in Cyerinica Province, Lybia, states that Radio Benghazi is preparing verification cards, and inquiries are being made into the priority that the station has on 7180 Kc, as against that of Baghdad which uses this frequency with 100 kw and much to the detriment of the Lybian station.

The station uses 7180 Kc 3.15-4.00 p.m., and on 6128 Kc 4.00 p.m. to 7.30 although it is presumed the latter is only a projected frequency and schedule.

The present shortwave equipment is used in the interim with telegraphic facilities, pending equipment of new shortwave transmitters. These will give national coverage with high power and incidence type antenna systems.

Ethiopia now broadcasts in Amharic at 3.30-4.30 p.m., 9.00-10.00 p.m. and 2.30 to 4.15 a.m., and in Somali from 1.00-2.30 a.m. on 6184, 7264, 9620 and 15345 Kc. The broadcasts, in English, are from 8.00 to 9.00 p.m.; and 4.15-5.00 a.m. on 9620 and 15345 Kc.

NOTES from readers on the stations they are hearing, should be sent to ARTHUR T. CUSHEN, 212 Earn Street, Invercargill, N.Z. All times are Eastern Australian.

BURMA ADDS 7118 Kc.

THE overseas broadcasts of the Burma Broadcasting Service, with programs radiated from Rangoon, using 50,000 watts, have added a new frequency in the 41-metre band.

The broadcasts from Rangoon were first noticed last June, using 11765 Kc, with an hour in English from 12.15 a.m. The frequency of 954 Kc was also announced as its meduim-wave relay. It has in the past few months been reported that Rangoon has also used 9540 Kc in the 31-metre band. Checks here have failed to hear this signal and we presume that the station announcement of 954 Kc has been taken in error for a shortwave channel instead of a medium-wave one.

The signal from Rangoon on both frequencies is now received here at good strength, with this session of English, at 12.15 to 1.15 a.m.

Attempts from listeners in all parts of the world to obtain confirmation of the reception of Rangoon have been without avail, though the station has been often heard asking for reports on the reception of the Burma Broadcasting Service. The Burma service in the past was carried on low-powered stations, and in prewar days the familiar callsigns of XYZ and XZZ broadcasting from Rangoon, were often heard in this area with transmissions in the 49 and 90-metre band. The station was in the past operated by the Burma State Broadcasting Service, and is now under the control of the Burma Broadcasting Service.

EXPERIMENTAL BROADCASTS FROM RADIO VIENNA

The experimental broadcasts from the Austrian Radio at Vienna are now released on several frequencies, and from Radio Australia we learn that the present operations cover stations in the 49, 41, 31, 25 and 16 metre bands. Power in most cases is only 4000 watts for these stations.

The Austrian Broadcasting Corporation announces in German, English, French, Italian and Spanish at the beginning and end of each broadcast.

OEI30 5985Kc 5.00-7.00pm and 11.00pm to 3.00am.
OEI20 6000Kc 2.30-10.00pm and Sunday 3.00 to 10.00pm.
OEI21 6155Kc 2.30-10.00am and Sunday 3.00-10.00am
OEI31 7135Kc 7pm-11.30pm.
OEI22 7245 10.30am to noon, 7.30-10.30pm, 3.00 to 9.00am. Sundays 10.30am to noon, 4.00-7.00pm, 3.00am to 10.00am (Monday).
OEI32 9505 2.00 to 5.00am.
OEI33 9615 3.00 to 5.00pm, Sundays 4.00 to 5.00pm.
OEI23 9655 5.00pm to 2.00am and 5.00-9.00am, to 10.00am Monday.
OEI35 11775 3.00 to 4.00am.
OEI24 11785 2.30pm to 3.00am.
OEI36 11935 Sunday 12.30 to 3.00pm. 12.30-2.00pm
OEI37 17795 11.00pm-1.00am and 2.00am to 4.00am.

FLASHES FRO EVERYWHERE

KUCHING broadcasting from Sarawak noted from both sides of the Tasman new frequency of 9565 Kc, in the 31-met when a program in Chinese is audible p.m. The station reverts to English br at 9 p.m. The signal suffers some inte from the AFRS Los Angeles transmis 9570 Kc. Sarawak was formerly oper 5055 Kc, in the 60-metre band, a frequenc it has been using since its inception son ago.

OMDURMAN in the Sudan, with br radiated from Khartoum, has increa schedule, reports Radio Australia. The is now operating from 2.15-4.30 p.m., 10. p.m. and from 12.30 a.m. to 7.30 a.m. now moved back to its old frequency Kc. In the past the frequency has vari low as 4975 Kc.

JERUSALEM, the home of the Broadcasting service of Jordan, has adde their new shortwave frequency, according to from the Middle East. The transmission carried on 11810 Kc, which is in add 6045 Kc. This latter frequency has operation for some months.

BRITISH SOMALILAND, with transmi Radio Somali, has left the old 40-met frequency of 7126 Kc, and is now on from 4 a.m. to sign off at 2.19 a.m station carries broadcasts in Somali to 1 and then in English until sign off at 2.1

KUWAIT in the Persian Gulf, has its transmission on 5000 Kc and now from 2.00 to 5.30 a.m. with music and in Arabic.

BELGIAN CONGO station OQ2AB broadcasts from Elizabethville, is on the on Mondays, and broadcasts to 2.00 7200 and 11.900 Kc. A further station city, OQ2AZ, Radio College, is on the days, 5.00 to 7.00 p.m. and weekdays fr to 3.30 a.m., using the frequencies of 27 and 7280 Kc.

TANGIER with its many stations h heard with a new callsign on 9270 Kc station identifies as Radio Eurafrica, v programs after 8.30 a.m.

VOICE OF UNITED NATIONS CON which broadcasts from stations in both Is Korea, is operating on a new schedule the World Radio Handbook. The tra times and frequencies are now as follows:

VUNC, Japan network carried on Naz Kc, from 9.30 p.m. to 4.00 a.m. using 1 Yamata, on 9560 Kc, 10 kw, 9.30 a.m.; Yamata, 6015 Kc, 10 kw, 12.30 4.00 a.m., while from Korea, VUNC 9.30 a.m. to 11 a.m. on 2700 Kc and both 1000 watts. The 7180 Kc HLKA tr also takes the broadcast for the perio p.m.-1.00 a.m.

PERU has made several callsign and f changes and a summary of the position f lows: OAX6H Radio Tecna operates on instead of 9505 Kc; Radio Nacional OAX6L formerly OAX6G now uses 937 on 9540 Kc. The callsign of Radio N on 6180 Kc is OBX4P, while the fr and calls for Radio and Continental at are OAX6E on 9335, formerly 6330, and on 3290 Kc.

MEXICAN station Emisoras Unidas c tan, Merida, uses 6105, and is on the from 11.00 p.m. to 3.30 p.m. The sta firms the reception of its broadcasts wit fication letter.

ADEN BROADCASTING SERVICE is to receive reception reports from listen an English correspondent who states th should be addressed to the Aden Bro Service, P.O. Box 264, Aden. The stati the air from 2.00 to 7.00 a.m. on 7170 k

SPANISH GUINEA is the location o station, using 6680 Kc, from 5.30 to 7 using the slogan Radio Contrava, and th has been heard by a listener in Germany

HONDURAS station HRPK with b originating from San Pedro is reported frequency of 5990 Kc, and is to be the U.S.A. at 12.30 p.m., when the statio

BRAZILIAN signals heard on 9535 Kc p.m. by Dick Pollard of Golden Dow have been identified by listeners as the relay of Radio Nacional in Sao Paul station is listed on this frequency, and grams of PRG9 which is on 6125 Kc p.m. to 3 p.m. next day.

RADIO AUSTRALIA will now be 15240 Kc, with the popular DX session days at 8 a.m. The station has mad quency change from 17790 Kc, which ha the session for many months. The new is assigned the call, VLC15. An additio mitter is now carrying the Indonesian 11840 Kc, VLG11 operating 8.14-9.30 a.

THE HAM BANDS WITH BILL MOORE

Extensive openings on the 50 Mc/s band have provided VHF amateur operators with opportunities of world-wide communication. Special permission granted to amateurs by many nations to operate on 50 Mc/s for the duration of the IGY will provide valuable information for propagation investigation.

working on 50 Mc/s during March are
en more interesting than in February, and
f the reported D.X. tallies of operators
markable.
ie story of the actual happenings will not
ly available until extracts from the logs
thered. The information available for
records will make interesting reading.
numbers of contacts were made between
stralian mainland—VK4 and KH6 and W

mode of propagation appeared to vary be-
F2 reflections, and judging from the time
y contacts, transequatorial scatter.

of the reported contacts were as fol-
n March 10, VK4NG, VK4XJ, VK4ZAZ,
and VK4HD, all worked KH6 stations,
rmance repeated on the following day by
On that date KH6NS, KH6UK, KH6PP,
6NCI were all audible between 1930 and
rs. E.A.S.T.
ig March 10 and 11, J.A.s could be con-
around 1100 hrs. E.A.S.T., and contacts
ade with both VK5 and VK6 according to
J.A.s have now communicated with
stralian States.
VK4s have lost count of the number of
t J.A.s they have worked on 50 Mc/s.
ir the last few months. They were audible
rters Towers on 24 consecutive days.

March 15, KH6CCZ contacted VK4WD,
3, and VK4HD. On the 16th, VK4NG
nced a remarkable period.
established communication with no less
W stations and 6 K.H.s. On that date
heard a W zero.
NQ lists contacts with all Z.L. districts
l-March and by that time ZL2DS had
31 J.A.s and 40 W6s, plus W7, W5, and
e of the W6s active is well known radio
Frank Jones, W6AJF.

March 15 ZL1WW listed 35W contacts,
ZL1UZ made the grade with XE1GE.

March 19 ZL1DE worked KX6AF, a contact
d on March 24 by VK4HD.

h 25 saw VK4HD again in contact with
ber of W stations.
band quietened from that date onward
w reports on D.X. working were avail-

the end of February 112 different J.A.
had contacted South America, all Q.S.O.s
excess of 10,000 miles.
March 21, JA2AQ lists 7LU and 2CX and
contacts. Mid-American stations W5 and
ve been working with ZS stations consist-
y

Special transmissions beamed to VK on 50 Mc/s. will come from KH6CCZ nightly between 1915 and 1930 hours E.A.S.T. He will listen at the conclusion of the transmission

The Sunday W tests on 50 Mc/s. will now commence at 1000 E.A.S.T., in view of the experience gained from Q.S.O.s made to date.

Prospects for 50 Mc/s. during May according to predictions should be favourable for Australian stations in the eastern portion of the continent south of Queensland. Possibly some of the VK2 and VK3 VHF enthusiasts may be able to repeat the feats of the VK4s.

At the time of writing the subject of who will be the first to receive official confirmation of a 50 Mc. WAC is undecided.

50 Mcs WAC

A NUMBER of W stations have made the required number of contacts, but all are experiencing QSL problems.

A special trophy presented by the West Palm Beach Radio Club for the first 50 Mc. WAC award winner has been waiting for a claimant at A.R.R.L. HQs since 1947 The prize is an impressive polished wooden stand mounted with silver figures. It would appear that a W6 will be the recipient. They were outsiders until late in 1957 when ZS stations broke through and made their African contact a possibility.

From Australia only two continents have been contacted. The JAs are well placed for high M.U.F. figures, but Africa and Europe present problems for those stations. South Americans also enjoy excellent VHF propagation conditions, but European 50 Mc/s stations have eluded them to date.

The A.R.R.L. trophy will be awarded to the station whose confirmations show the earliest completion of a 50 Mc/s WAC. The award will be held for a suitable period to allow all stations to forward their cards for perusal. The usual WAC rules otherwise apply.

Bob Perry, K6GDI, is the potential winner. He worked with his last continent on November 13, but still awaits a confirming QSL Bob used a pair of 4E27s in the final and a seven element Yagi Beam.

Transatlantic working received a boost when it was announced that G stations in selected portions of the British Isles were permitted operation on 50 Mc/s. For the duration of the I.G.Y. they may use 52.5 Mc/s. and above with inputs up to 500 watts.

Swiss stations may also use 50 to 54 Mc/s. for the period.

REPARATIONS FOR THE GENEVA CONFERENCE

IONAL Radio Amateur Societies in most
untries of the world are seriously review-
possible trend of deliberations at the forth-
I.T.U. conference. Special action is
taken in an endeavour to ensure there is
tailment of the current amateur frequency
ions.

conference is officially titled, "The Ordin-
Administration Radio Conference," and is due
on July 1, 1959.

past years the views of national societies
aried on the value of direct amateur rep-
tion at such conferences. The experiences
two radio societies of Great Britain dele-
(the only exclusive amateur representatives)
antic City in 1947, leaves little doubt as to
lue of such representation. They were
sible for the retention of their top band
metres) for the use of amateurs in the
In "Current Comment," under the title,
ing for Survival," it is pointed out that
more than the "Top Band" is at stake at
a.

ough the years, A.R.R.L. officials have
d out that the most important work in ob-
support for radio amateur claims is done
ference before any delegation leaves for an
conference. It is at this stage that most
ns will be made affecting amateur radio
country. The follow on by direct repre-
will certainly assist to press the amateur's

Atlantic City most of the frequencies lost
to shortwave broadcast stations.

ether propaganda shortwave broadcasting
any useful purpose is a matter for con-
; at Atlantic City many nations wanted
frequencies for that purpose. There seems to be no reason to anticipate any change in that attitude and other services will be demanding additional frequencies. Pressure groups will again be active trying to corner more frequencies and judging from experiences at these types of conventions the amateur bands are particularly vulnerable.

Since 1947, amateur operators throughout the world have further consolidated their fine record in the public service and on propagation studies. In Australia their work especially in floods since that time has received much acclaim from public bodies, the Press, broadcasting services and individuals. It seems reasonable to hope that we would receive even greater support for the retention of our bands than at Atlantic City.

Amateurs have on many occasions provided a public service at no cost to any governmental department or individual.

At Atlantic City a number of nations varied amateur allocations from those listed for their particular zone. Generally amateurs in Europe received the worst deal in amateur frequency assignments. Amateurs in the Americas received the largest segments, on frequencies from 3.5 through to 21 Mc/s. These stations were permitted to use 1,600 Kc/s, here in Australia 1,250 Kc/s.

The proposal of the Wireless Institute of Australia to such a delegate to the forthcoming I.T.U. Conference deserves to receive the support of all Australian amateurs.

The cost to the individual will be small—around £1. Most divisions of the institute have at this early stage opened subscription lists and subscriptions are solicited from members and non-members alike. Donations should be made direct to your State W.I.A. organisation.

N.S.W. ANNUAL MEETING

THE annual meeting of the N.S.W. Division of the W.I.A. was held in March. Attendance was excellent. Reports of the president, Peirce Healy, VK2APQ, and auditor Bill Yates, VK2AWY, were adopted with acclamation. These documents accurately reviewed the year's activity and were prepared with a thoroughness that did credit to the originators.

There will be only one change in the new council for 1957/58. Only seven members nominated and no election was necessary. The retiring member is Keith Woodward, VK2ZAU.

The council for the ensuing year will be Peirce Healy, VK2APQ; Norm Beard, VK2ALJ; Bob Godsall, VK2ARG; Ted Smith, VK2CD; Max Sobels, VK2OT; Dave Duff, VK2EO and the new member, Morrie Marsden, VK2VV.

It is not anticipated that there will be any radical changes in official positions, which will be filled at a later date.

Three new life members of the N.S.W. Division of the W.I.A. were elected at the annual meeting. They were: Past president, John Moyle, VK2JU; past vice-president, Bill Lewis, VK2YB; and past secretary, Dave Duff, VK2EO.

All have been closely associated with institute activity over very many years. John was responsible for the formulation of much of the division's policy in the past, and was co-opted by F.E. to draft the original uniform divisional articles. Bill joined the division in 1929, and is the oldest member still actively engaged in W.I.A. organisation. Behind the scenes he still prepares the envelopes each month for the despatch of the monthly bulletin.

Dave served as divisional secretary, and in recent years as engineer for VK2WI. He has been mainly responsible for the technical improvements at VK2WI. Today the institute's transmission is one of the best and certainly one of the most effective heard on amateur bands.

The normal monthly meeting followed and Mr Stan Graves, of the School of Electronics and Communication, lectured on Class "C" Amplifiers.

The aim of the division is to increase its membership to 1,000 in the new year. Toward that goal, 14 new members were elected at the meeting.

Q.S.L. cards held at the bureau have been sent out to all non-members enclosed with details of the division's activity and an application form for membership. Already a number of forms have been returned and this valuable departure from routine should do much to publicise the W.I.A. to those outside the institute.

The inaugural meeting of the N.S.W. W.I.A. shortwave listeners' section was held at the TV Studio, Gore Hill Technical College, on April 14. Many W.I.A. divisions have conducted S.W.L. sections for years; this is the first venture in this field in N.S.W. since the 30s. It is hoped that all S.W.L. members in Sydney will take advantage of the new facilities provided by the division. Meeting dates will be published from time to time.

SATELLITE TRACKING

IT is three months since the launching of the original American satellite, and a group of radio amateurs are still busy tracking the progress of the three moons. Alpha, Beta and Gamma still in orbit. The team, comprising Hugh Stitt VK2WH, Neville Wilde VK2DK, and John Miller VK2ANF, is well known for its contributions to the I.G.Y. programme. The transmissions from the three satellites can be identified from the peculiarities of each signal.

One transmission has a slow fade, one a fast fade, and the other is steady, due, it is believed, to the rate of rotation of each satellite. The mentioned amateurs have spent more time on the project than they can possibly afford recording the necessary data. They normally report on six out of the 18 orbits each day, every check taking approximately half an hour.

Often an hour is spent each day to co-ordinate information and another hour each evening for the VK5WI schedule.

Gordon Bowen, VK5XU, takes the VK5WI schedule to relay information to I.G.Y. headquarters, Adelaide. All amateurs participating in this work have worked willingly in an endeavour to provide data of value to the I.G.Y. program. They are entitled to praise from all amateurs for their contributions on behalf of the movement.

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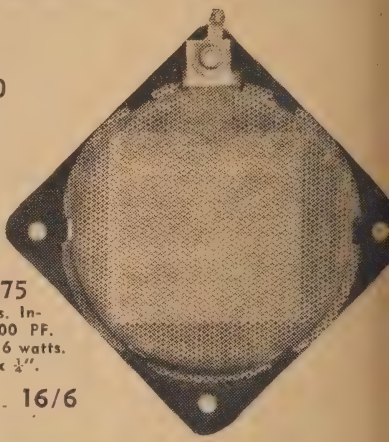
TWEETERS

AUDIO ENGINEERS announce further supplies o these famous AE Models LSH75 and LSH100 Electrostatic tweeters are now available. An additional unit, the Model LSH518, has been added to the range and details are as shown below.

AE Model LSH100
(at left) 7-18 K/cs. Inherent capacity 1100 PF. for inputs up to 20 watts. Size: 5" x 4" x ¼".

PRICE 27/6



AE Model LSH518
NEW "WIDE ANGLE" Tweeter. Size: 7 1/8" x 2½" x ¼".

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AE Model LSH75
(at right) 7-18 K/cs. Inherent capacity 800 PF. for outputs up to 6 watts. Size: 3" x 3" x ¼".

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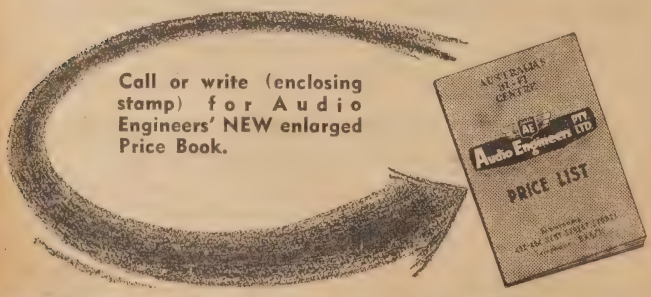

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UNGA CONVENTION

tenth annual convention of the North zone of the W.I.A. was held at Urunga aster.

ther as usual was good and 73 persons d including VK2AHH, 2ACU, 2VV, 2ALJ, 2RU, 2BZ, 2APQ, 2SF, 2ZCK, 2PM, 2GV, 2FH, 2ASZ, 2FP, 2XT, 2ZCQ, 2JS, 2PY, 2AEU, 2AHA, 2AWG, 2ADM, XO, 4VS, and 3ALQ.

ciate Norm Dash was secretary for the tion.

event opened on the Friday evening when of W.I.A. organisation were discussed.

nt to supply the correct answers were: resident Peirce Healy, VK2APQ; State sec- Norm Beard, VK2ALJ; and Councillor Mor- arsden, VK2VV.

ners of the various field events were: 44 Mc/s transmitter search, John Pickles, Gerry Challender Memorial Contest, Noel n, VK2AHH; Nocturnal 144 Mc/s Hunt, Pickles, VK4FP; Second 144 Mc/s Hunt, mmings, VK2PM, and the Urunga Scr t in a tie between John Pickles, VK4FP on McKenzie, VK3ALQ.

contacted a W7 during the scramble.

osal equipment sales were in the capable of Allan Williams, VK2FH, assisted by Beard, VK2ALJ.

Pike, VK2ACU, now a resident of Urunga, all amateurs that next year's event will ger and brighter.

frequency checks and the location of Rus- putnik transmissions, the following informa- nay be useful to identify WWV and H. They provide standard frequency trans- s from Maryland, U.S.A., and Maui, Ha- respectively. The service is conducted by ational Bureau of Standards, U.S.A. smissions are made on 2.5, 5, 10, 15, 20, Mc/s. Time announcements are made -minute intervals by voice and morse code.

dard time intervals are provided at 1 , 1, 3, and 5 minutes. Standard audio ncies of 440 cycles and 600 cycles are also o modulate the transmission. Radio propa- disturbances data is supplied and con- the letters W, U and N, together with 1 through 9 and indicate conditions on orth Atlantic path.

audio frequencies are interrupted at pre- two minutes before the hour and each five s thereafter.

are resumed precisely on the hour and ve minutes thereafter. Code announcements G.M.T., using the 24-hour system beginning 0000 at midnight. Voice announcements erica give E.S.T.

audio frequencies are transmitted alternate- The 600-cycle tone starts precisely on and every 10 minutes thereafter, continuing ree minutes. The 440-cycle tone starts pre- five minutes after the hour and every 10 s thereafter continuing for three minutes.

fourth minute of each five minutes is and voice announcements are made in the inute. The one-second intervals are heard clock-like tick, the tick at the beginning last second of each minute is omitted.

ELD DAY ON 144 Mcs

the third successive State-wide 144 Mc/s Day, participants in the N.S.W. Division's and TV sections outing found propagation ions poor. Many stations were located in ld within a radius of 150 miles of Sydney. longest distance covered was over a fairly e path between Hugh Stitt, VK2WH, of , and Keith Dodd, VK2AA, near Tumut, iles apart.

hest west in the field were VK2JW and L at Mt. Canoblas.

he Blue Mountains were VK2ANF at the t. VK2ZBG Mt. Tomah, VK2ZCF Mt. VK2OA Mt. York, and VK2HL Mt. Lam- VK2ZAV was at the Gib, near Mittagong. VK2AHH Mt. Ebor, near Armidale. In uth, VK2ZAA was at Kendall.

he stations in the country active were: AN Bathurst, VK2DR Blayney, VK2WH , and VK2ZDL and VK2ZDF at New- A number of contacts made on Saturday g could not be repeated on Sunday.

ons at home and in the field enjoyed the e handling event. Final place-getters will announced until logs are examined. The tition was divided into three sections, port- home country and home city stations.

A.O.C.P. CLASSES

next A.O.C.P. class to be conducted by the . Division of the W.I.A., at the Railway te, Castlereagh Street, Sydney, will com- in July. Intending students can obtain ation on the class by communicating with Secretary, N.S.W. Division, Box 1734, , Sydney. The class covers instruction in theory to allow students to sit for their r licence.

Currently, the division will conduct an P. course by correspondence, and will the same series of 46 lectures.

s a new departure for the division and assist country enthusiasts to obtain their P. or L.A.O.C.P.

ested persons should communicate before d of May with the secretary of the N.S.W. n at the above address.

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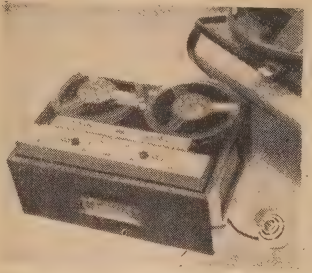

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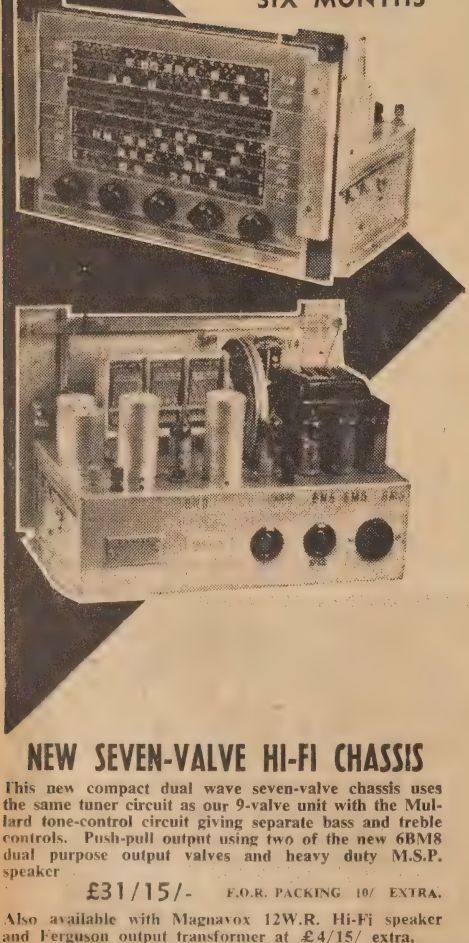

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Tone control and audio stages incorporating the Mullard 5/10 amplifier with separate bass and treble controls giving plus or — 15 db. boost at 50 cycles L.F. and 10,000 H.F., combined with push-pull outpu inverse feed-back gives you really high fidelity reproduction from your or favourite recordings.

NEW:

Dual Speaker combination, using a heavy duty woofer (12in M.S.P. Jensen special) with matching 6in tweeter and cross-over network giving a fr response of 46 to 13,000 cycles. Speakers are mounted coaxially makin one 11in mounting hole necessary.

NEW:

If required the new Magnavox high-fidelity twin coned speaker can be u Large calibrated edge-lit dial in plate glass (11in x 7in) with main stat each State in prominent type. Dial fitted with counterweight drive, giving tuning. Indicator lights are fitted showing which band is in operation can be supplied in cream, black or brown with matching knobs and escu to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple an five even on interstate, overseas and country stations.
All chassis are wired for the fitting of an F.M. tuner or tape recorder, plug being provided on back of chassis, also pick-up terminals and ou gramo motor.
Power switch is fitted to volume control, radiogram switch, combined wit change switch. Audio end of set can be used with TV receiver if require

A NINE VALVE HIGH-FIDELITY RADIOGRAM CHASSIS

Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT Frequency response 40-13,000 cycles. Max. output 10 watts.

£41/15

F.O.R.

A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

WITH BASS AND TREBLE BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications are nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

£44/15

F.O.R.

NEW SEVEN-VALVE HI-FI CHASSIS

This new compact dual wave seven-valve chassis uses the same tuner circuit as our 9-valve unit with the Mullard tone-control circuit giving separate bass and treble controls. Push-pull output using two of the new 6BM8 dual purpose output valves and heavy duty M.S.P. speaker

£31/15/- F.O.R. PACKING 10/ EXTRA.

Also available with Magnavox 12W.R. Hi-Fi speaker and Ferguson output transformer at £4/15/ extra.

Write for full specification

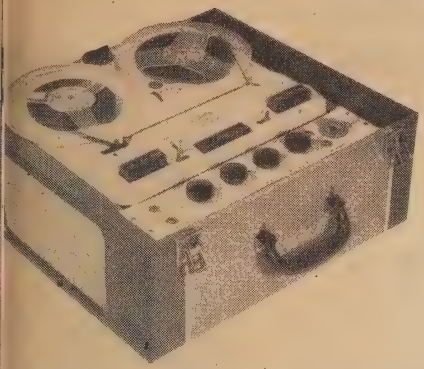
ALL 4 SPEED RECORD CHANGERS AND PLAYERS STOCKED

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145

uying a Tape Recorder?

t see and hear the new Hi-Fi Recorder by Classic incorporating the Collaro Mark 111 Transcription deck. The only deck with ALL these features.



COMPLETE UNIT IS SUPPLIED IN RACTIVE AND DURABLE TWO-TONE STIC COVERED CASE COMPLETE WITH ACOS MICROPHONE

ix-valve amplifier incorporates the latest "Mullard" ecorder circuit equalised to C.C.R. standards giv- erfect reproduction from recorded tapes. Record oring and outlet to power amplifier. Extension er outlet and "magic eye" level indicator. Ampli- completely shielded and fitted with perspex dress to match deck.

- **HIGH FIDELITY**
Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7½ inches per second. Azimuth adjustments on both impedance "record" and "playback" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7½ inches per second.
- **INSTANTLY REVERSIBLE**
Instantaneous changes can be made from one track to the other. Fast rewind in either direction.
- **CONSTANT TAPE TENSION**
A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.
- **FULLY MECHANICAL**
No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical.
- **FINISH**
Cream Polystrene cover plate with maroon controls.
- **THREE SPEEDS**
3¾, 7½ and 15 inches per second.
- **FOR HEADS**
Two "Record/Play-back" and two "Erase" heads are sited on two different levels and head wear thus halves for any given length of track.
- **TWIN TRACK OPERATION**
One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape.
- **PAUSE CONTROL**
This has the effect of stopping the transit of the tape past the "Record/Playback" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected position. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURING & CALIBRATING DEVICE**
The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter to less than 0.15 of 1.0 per cent.
- **TWO MOTORS**
Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

OMPLETE RECORDER WITH MIKE—80 GNS. f.o.r.

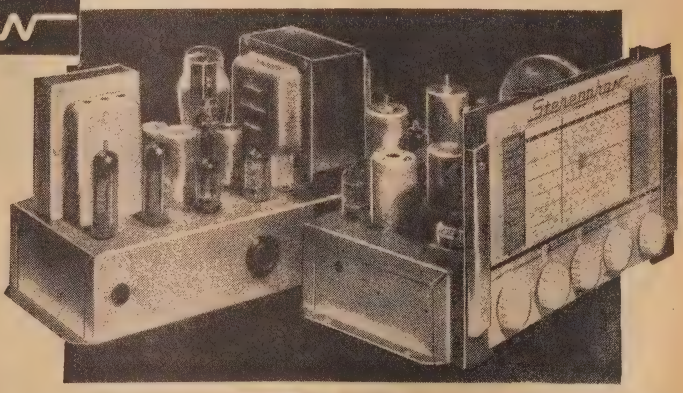
DECK WITH AMPLIFIER, POWER SUPPLY & 6in x 9in SPEAKER 70 GNS.

Stereophon

—LIVING SOUND—

ompact 11-Valve -grade Radio- in two chassis ring a variable -width Tuner, i-input preampli- and Tone Con- in one unit and Watt Ultra-linear lifier. Ideally d for use with -grade pick-ups speakers.

65 GNS. F.O.R.



Classic Radio

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TEST GEAR COSTS YOU LESS

...When you build it yourself

UNIVERSITY OFFERS THESE INSTRUMENTS IN KIT FORM AT ONLY A FRACTION OF THE ASSEMBLED PRI

VACUUM TUBE VOLTMETER Model EVK

Model EVK incorporates the W4 all polystyrene meter and overall size is only 8in x 6in x less than 4in. Designed to operate from 240 A.C. mains, it comes complete with every component. All resistors, shunts, multiplier, meter, etc., are carefully pre-calibrated at the factory.

The easy to follow instruction booklet supplied with every Model EVK is filled with diagrams and stage by stage assembling and wiring steps.

The ranges of Model EVK are:

D.C. Volts: 0-5-10-25-50-100-200-500-1,000.

A.C. Volts: 0-10-40-50-200-250-1,000.

Ohms : 0-1,000-100, 000-10 Meg.—1,000 Meg.

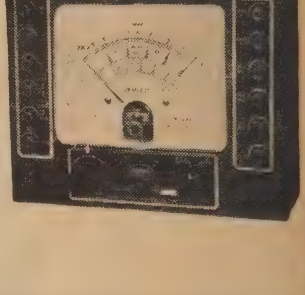
A polarity reversing switch is fitted for D.C. voltage range.

OSCILLATOR KIT Model OK1

Available as complete kit or assembled. Covers all fundamental frequencies in the average receiver Standard batteries are used and each OK1 is supplied complete with instruction book.

MULTIMETER KIT Model MK1

Has a wide range of A.C. and D.C. voltages up to 1,000 volts and measures current in the range of 1, 10, 50, and 250 milliamperes, and resistance readings up to 100,000 ohms. Has U4 square meter with clear multi-scale. Supplied either as a kit or assembled. Full details for assembly are given—photos and diagrams make job easy.



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NDAMENTAL RANSISTOR THEORY

ontinued from page 49)

rier in this type of material, this e germanium.

der to understand the action in- a transistor, it is necessary for ook upon the hole as a positive rrent carrier as compared to the being a negative type current The hole can effectively be from atom to atom the same as ron can be moved from atom to

igure 13, the indium atom has oved over to the left a little bit more of the germanium atoms crystalline structure. When this germanium crystal was produced, e appeared in the outer ring of um atom since it had only three s, to combine in co-valent bond-

difference of potential were to ied to this material so that the electrode were to appear to the the drawing and the negative l appear at the right, there e a tendency for an electron to ed from right to left due to the e of this voltage.

negative potential on the right repel an electron toward the left positive potential on the left attract an electron.

is case, one of the electrons in the outer ring in one of the other germanium atoms will be dislodged and will travel over to the indium atom, filling up the hole. Effectively now, we have had hole movement from left to right.

In other words, the hole can be said to have travelled from the indium atom to the right to the germanium atom, since the hole now appears at that point.

To understand the theory of operation of transistors, it will be necessary to accept the hole movement theory remembering that any time a hole moves in one direction, an electron will be moving in the opposite direction.

The hole current theory is very important in transistor theory. The hole may be treated as a positive particle which acts just like an electron except that is has the opposite charge and therefore, will travel in the opposite direction of an electron. One hole is created for every indium atom present and is considered to have the same mobility as an electron.

(To be continued)

THE LIGHT FACTOR IN PLANT LIFE

(Continued from Page 17)

It assumes that this plant requires certain chemical reactions to proceed at a slow rate in order to transform terminal buds into flowers. Certain chemical reactions are commenced by photosynthesis and are brought to completion only if the process is not broken by light. A certain amount of light is required for the commencement of photosynthesis only. After an optimum period of light there must be darkness to complete the reaction.

It appears that the two reactions do not take place simultaneously. One is during the day and the other at night.

The economic importance of the phenomenon of photoperiodism is manifest in the scientific study of the selection of crops to conform to the length of day in various latitudes.

For instance in the growing of wheat, the Australian early wheat is no good for the English climate, whilst the English late wheat is no good in Australia. It has been found by experiment that one of the causes of this is the fact the Australian wheat is a short day (long night) variety whilst the English variety is a long day (short night) kind.

Very many plants are influenced by this day length and no doubt better crops will result by further research into the best varieties of plant for various latitudes. Recent advances in this knowledge is already explaining the failures or successes of various crops, due to them being of the incorrect variety for a particular climate and latitude where the length of the day or night is of supreme importance.

TRIMAX

have TRANSFORMERS for the

TRANSISTORIZED TELEPHONE AMPLIFIER

(see article Radio, TV & Hobbies, April 1958 issue)

- INTERSTAGE TRANSFORMER, TA1426
- OUTPUT TRANSFORMER, TA1427

These Transformers have been designed for use with an OC71 to push-pull OC72 amplifier circuit feeding a 3.5 ohm speaker.
Backed by the name of TRIMAX you can be sure of SERVICE and DEPENDABILITY!

Available through your local TRIMAX supplier

TRIMAX TRANSFORMERS PTY. LTD.

WILLIAMS ROAD & CHARLES STREET, NORTH COBURG, VIC. FL1203

Reps.: N.S.W.: University Graham Instruments; QLD.: C. A. Pearce; STH. AUST.: Neil Muller; WEST AUST.: R. D. Benjamin; TAS.: W and G. Genders

NEW VALVES AT BARGAIN PRICE

1T4	10/	1Q5G	5/	6U7G	6/6	VR65A	2/
1S5	10/	1P5G	5/	6Y6GT	12/6	CV6	3/
3S4	10/	1C7G	5/	6X5GT	10/	36	7/
3V4	12/6	1K5G	2/6	6J7	5/	7193	3/
1R5	12/6	6AC7	2/6	6U7G	5/	954	4/
1A7GT	9/6	6C8G	7/6	6J6	15/	955	10/
1D8GT	9/6	6S57	8/6	6F8G	10/6	12A6	10/
6A8G	10/6	6F6G	9/6	6A3	15/	EF50	2/
6K8G	9/6	6E5	8/6	7C7	3/6	110TH	£2/9
6SJ7GT	9/6	6H6	2/6	7A6	3/6	811	£
6X5GT	10/	6H6GT	1/6	78	7/6	866/866A	15/
12K8	10/	6J7G	7/6	71A	7/6	828	£1/9
12SK7	7/6	6K7G	3/6	EL32	10/6	12SH7	5/
EK32	10/6	6K7GT	7/9	KTW62/6U7	6/6	12SL7	10/
6SATGT	9/6					6K7G	4/
830B	12/6					100TH	20/
6SH7	3/6						

Please add Postage on All Valves.
SPECIAL PRICES FOR QUANTITIES.

New Power Transformers

60mA prim.: 240v with 230v tapping, Sec. 285 x 285 with 6.3v filament winding. 60mA.

27/6

Plus Postage: N.S.W., 3/6; INT., 5/3.

NEW 4in Per-Mag. Speakers

5T. or 7T. Trans., 30/.

30/-

Post. and Packing, 3/6.

New Midget Power Trans.

40mA Prim. 250v Sec. 225 x 225 with 6.3v. Fil. Winding. Upright or Flat Mounting. Size 2in x 2½in.

25/-

2/6 Postage, N.S.W.; Interstate, 4/6.

30mA, 240v. Prim. 150 x 150v. Sec. with 6.3v. Fil. Winding.

22/6 Postage, N.S.W., 2/6; Interstate, 3/6.

BUILDING R. TV & H. TV SET

All Major Parts in stock, including R.C.S. IF Strips and Tuners. Valves, Power Transformers, Chassis, etc.

NEW DYNAMIC HEADPHONES

These headphones made by Rola are a high quality unit giving excellent tone. Fitted with comfortable ear pads.

25/- Post 4/6.

NEW No. 7 HAND MICROPHONE

with Switch Dynamic Unit.

25/-, plus Post.

VALVE SPECIALS

20/- will purchase any one of the following Valve Specials.

5	1P5	3	6K8G
6	1C7	6	6SH7
5	1Q5	8	6AC7
12	1KS	5	6J7G
6	954	4	6U7G
6	6C8G	4	12A6
10	EF50	2	6X5GT
12	VR65A	7	6K7G

Post and Packing, 4/6 extra.

ALL VALVES ARE NEW.

NEW 6H6 OR 6H6GT VALVES

Individually Cartoned.

12 for 20/-

Post 2/6.

New Transmitting Valves

803	30/-
100TH	£1
866	12/-
811	15/-
830B	12/6

New Micro-Ammeters

New Paton Micro-Ammeters

0-500,mA, 1¾in diameter. Flush mounting.

25/-

Post and Packing, 2/6.

CONDENSER SPECIAL

Boxes of 100 new mica paper and electrolytic condensers in values ranging from 50pf mica to 5 400v. paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 500 mfd/12v., .10 mfd/40v., 8 mfd/525v., 16 mfd/350v., electrolytics.

25/- per 100.

Post Extra: N.S.W. 2/6; Int. 3/6.

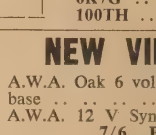
NEW VIBRATORS

A.W.A. Oak 6 volt Synchronous base

A.W.A. 12 V Synchronous octa

7/6. Post 1/6.

NEW PUSH BUTTO SWITCHES 20/-



Five pole push switches.

New control fitted with switch. also 5 with globes and contact by key

Post: N.S.W.

Int.

NEW I.R.C. RESISTO

I.R.C. carbon resistors, ½, 1 and 2 in values 50 ohm, to 5 meg., incl many popular sizes, 3T, 15T, 25T, 50T, 100T, 250T, 500T, etc (Standard resistor colour code sup

100 for 25/-

(Plus 1/6 postage.)

New High Impedan Headphones

30/- Post 1

Telephone Generato

New small telephone generators, for bell ringing, etc.

10/6 Postage 3/- e

GERMANIUM DIOD

for that Crystal Set.

7/6. Post Free.

511A C.R. TUBES

These 12in tubes have been r mended for TV use in "Radio W Uses same sockets as VCR97.

£4/17/6 F.O.

Please address all correspondence to 332 Parramatta Road, Stanmore, N.S.W.

METROPOLITAN RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM73
640 KING STREET, ST. PETERS, N.S.W. PHONE LA60

TRANSCEIVER SPECIALS

No. 22 TRANSCEIVERS

T 22 transceiver covers a frequency of 2 to 8 Mcs. and has been oved by the P.M.G. for use on fishing boats, small craft, bush fire ades, etc., if converted to crystal control, for which it is easily ted. These sets are supplied complete with valves, 12v. vibrator er supply, dynamic headphones and microphone leads.

No. 19 TRANSCEIVERS

These units cover a frequency of 2 to 8 Mcs. and contain 15 6.3 volt valves including 1-807, 2-6V6, 6-6K7, 2-6K8, 6B8, etc., also 500 micro-ammeter.
Units supplied complete with valves, leads, junction box, genemotor power supply and dynamic headphones and microphone (operate from 12v. supply).

PACKAGE 15/- EXTRA

£7/15/-

No. 11 TRANSCEIVERS

plied complete with valves, high and low power genemotors, leads, phones and microphone.

£6/15/- F.O.R. PACKAGE 15/- EXTRA

No. 108 TRANSCEIVERS

These 6-valve Walkie-Talkies are supplied complete with valves, headphones and microphone.

£7/15/-

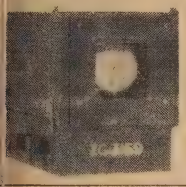
MERICAN HANDY TALKIE. SUPPLIED WITH VALVES BUT LESS COILS AND CRYSTALS. TYPE BC/611, £8/15/-, POST AND PACKING 15/- EXTRA.

NEW 5 BPI C.R.O. TUBES £2/17/6

—IN ORIGINAL CARTONS—

FOR THAT TV SET OR OSCILLOSCOPE

CERAMIC SOCKETS FOR ABOVE 4/6 EXTRA (Post and Packing Freight Rate—N.S.W. 12/6, Interstate 17/6.)



NEW INDICATOR UNITS

These new indicator units contain 3 valves, controls, etc., and V.C.R. ACR/10 C.R.O. tube and socket. Ideal for the small scope. **£3/10/-** F.O.R.

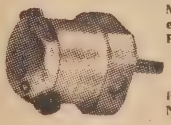
RADAR RECEIVERS

ese radar receivers type ZC955 contain 16 ves and a 30 Mc I.F. strip suitable for your experiment. Units are in new condition.

£2/17/6

Packing 15/- extra.

24 Volt Midget Motors Shunt Wound

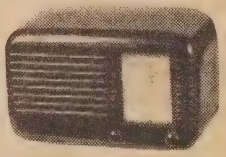


Fully Laminated Fields Wound Armature Sixteen Segment Commutator. ball-bearing. Ideal for Model Trains, Hobbyists, etc., Condition new. Price, each

25/-

Packing and postage: N.S.W.. 1/6; Interstate, 2/6.

MAKING UP THE "LITTLE GENERAL"?



£12/17/6

Complete kit of parts for the 1957 "Little General" as featured R and H including attractive bakelite cabinet with slide dial. Price includes valves and Rola 5F speaker and kit is complete to the last nut and bolt. (Set wired and tested £2/15/- extra).

Cabinet size 11½in long, 7in high, 6in deep. Foundation Kit for above comprising Bakelite Cabinet, Chassis and Dial Assembly .. 57/6

Post and Packing: N.S.W., 14/6; Interstate, 25/-.

SPECIAL—FREE VALVE OFFER

WITH ALL ORDERS OF £6 OR OVER SIX NEW VALVES SELECTED FROM THE FOLLOWING LIST WILL BE SUPPLIED FREE. (COUNTRY ORDERS, PLEASE ADD 2/6 EXTRA POSTAGE.)
Q5GT — 1C7G — 6H6GT — 6K7G — VR65A — EF50 — 954 — 6C8G — 1P5GT — 1K5G — 7193 — CV6 — 6J7G — 12SK7.

New 3in. R.F. METERS

Supplied with New Scale to Convert to 0-10 or 0-100 mA METER, 7/- PLUS 2/6 postage.

CO-AX CABLE

ght 90 Ohm Twin Co-ax
/3 YARD, plus postage.

CO-AX. CONNECTORS

PYE TYPE .. .. .. 4/- Pr.
AMERICAN .. .. .. 6/- Pr.

New Throat Microphone

3/6 plus postage

NEW MICRO SWITCHES

5/6 plus postage

METROPOLITAN RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM7398
640 KING STREET ST. PETERS, N.S.W. PHONE LA6087

VARIABLE CONDENSERS

Single Gang New

10/- ea.

Post, N.S.W., 2/1. INT. 3/3

MANIFOLD PRESSURE OR VACUUM GAUGES NEW £1

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BRAND NEW

£1 ea.

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AIR SPEED INDICATORS

New

£1

Post, N.S.W. 2/1. Int. 3/3.

AIR PRESSURE GAUGES £1

0-220 lbs ins.

Post, N.S.W., 2/1. Int. 3/3.

AIR COMPRESSOR UNIT

with Oil Trap and Air Hose. New.

£3/19/6

Post, N.S.W., 6/5 Int. 9/6.

No. 19 TRANSCEIVERS

2-way Radio, with Genemotor and 15 standard valves. Good condition.

£7/10/-

Freight payable at nearest attended railway station.

RANGE FINDERS

Horizon and Bubble Type, Brand new Mark IIIB.

Complete with Leather Case.

Dimensions, 9in x 4in x 2in.

Ex-R.A.A.F

ORIGINAL COST £30.

PRICE 35/-

Post, N.S.W. 3/2, Int. 4/7.

CAPACITATORS

4 MFDS, 600V 4/
4 MFDS, 400 V 3/
1 MFDS, 350 V, On Bracket .. 2/
2 MFDS, 250 V 2/6

POST N.S.W., 2/3. INT., 3/11

P8 COMPASS

RECONDITIONED AS NEW. Liquid Filled. Ex-R.A.A.F., 4in diameter. Cost £35. Ideal for small boats, etc.

Special price

£3/15/- each

Post, N.S.W., 5/2. Int. 1/6.

PANEL CONTAINING

20 ½-watt Resistors
16 Condensers
4 1-watt Resistors

The Lot 7/6

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TELESCOPES, Ex-Army

Ottway of London. With variable power adjustments. Length 26in. Weight 12lb.

£12/10/-

Freight payable at nearest attended railway station.

TELESCOPES, Brand New

30-POWER. Coated Lenses

£5/15/- Post, N.S.W., 4/5 Int., 5/10.

PRISMATIC COMPASSES

Ex-Army. LUMINOUS Guaranteed Correct.

£7/15/- each

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OTTWAY LEVELS

with high-power telescope. Will do dumpy work. Cost £300, Special £15 each.

CHOKES

70 M.A. 6/11 ea.
IRON CORED IN CAN 5/ ea.
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BATTERY CHARGER

LIGHTWEIGHT NEW EX-ARMY 18 VOLT, 80 WATTS, 4.5 AMP. 4 STROKE SINGLE CYLINDER AIR COOLED ENGINE 35 C.C. ALSO HAS A.C. OUTPUT OF 300 CYCLES/SECOND AT 3,000 R.P.M.

COMPLETE WITH TOOLS, SPARES AND WORKING INSTRUCTIONS.

£35 ea.

Packing 10/ EXTRA

EXHAUST FANS

NEW VENTAXIA

£9

Post N.S.W., 6/2. INT., 9/6.

TRANSFORMERS

CANADIAN TRANSFORM
VOLTAGE UNKNOWN.
THESE CAN BE REWOUN

15/- ea.

HEAVY DUTY
240 V INPUT
6.3 V, 5V
325V Ext. 400 V.
A.W.A.

£4/15/- ea.

HEAVY DUTY
PRIM 240 V 1.5 AMPS
SEC 22-OKILO VOLTS
0.015 AMPS.
RATING 0.33 K.V.A. WIN
DOUBLE
PHASE 1. FREQ. 50 CYC
A.W.A. £10 ea. F

EX-NAVY, 5/ ea.
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0-210-230-250 V. PRIM.
6.3 AMP CENTRE TAPP
5 V 2A.M.P. 315-0-315

35/-

115V-400-0-400V.
400V-270-0-270V-400V.
ALSO CONTAINS 3 FILAM
WINDINGS

35/- ea.

115 V to 6.3V TRIMAX

Use two of these with Prim in and obtain 6.3V Twice or With secondary in series.

10/- ea.

115 V PRIM
5.1V AT 26 AMPS OUTPU

£1 ea.

DEITCH BROS

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HI-FI SYSTEM FOR £84-13-0 or £20 Dep.

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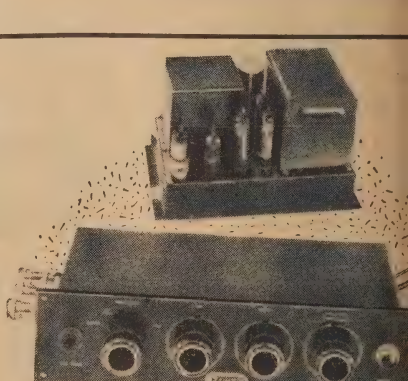

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NSWERS TO CORRESPONDENTS

(Murwillumbah, N.S.W.) would like to
nc of the Zenith Trans-Oceanic portable
—which appeared on the cover of the
issue.
part from the cost, which would probably
£150 in this country, you might have
the Customs people a very good story
to get an import licence for the set.
ik that it would be better to shop around
You may not get all the features of
tal set, but you may be able to obtain
g well worth while at a good deal less.

(Elsternwick, Vic.) tells of how he re-
TV receiver.
e must give you full marks for detective
.W.D. The story is too good to do
n these columns, and the best we can
o pass it on to the "Serviceman Who
No doubt our serviceman will see fit
it on to readers at a later date.

(Terang, Vic.) says he was much interested
recent Amateur Bandspread Tuner but
ke to have seen coil data, etc., for the in-
al short-wave bands.
We could not say off-hand whether the
could or could not be adapted readily
international broadcast bands. Careful
ould have to be given to the number and
on of such bands and their width in terms
acycles. We can keep your request in
ut aren't very optimistic at the moment
ur chances of getting on to it.

M. (Heetonville, S.A.) writes to express
reciation of the magazine and the help
has been in learning about radio. He
a circuit he has evolved around our
or Amplifier for Crystal Sets and other
r circuits, and which he has operated suc-
on both the broadcast and S.W. bands.
gests we think he should publish it in
"Reader Built It" page.
any thanks for your comments and kind
, and it is gratifying to learn that you
und the magazine so beneficial. Many
also for the circuit and report on its
nce. At the time of writing we have
t time to analyse it fully, but we will
in mind for possible use as you suggest.
that the reception of S.W. or V.H.F.
would probably involve a fair amount
ice, since it is unlikely that the set would
very high gain. However, considering
nber of public utilities, etc., using these
s, there is always a fair chance that a mo-
it in the vicinity will be picked up. Our
to Sputnik, is fairly adequately ex-
in the November editorial and we agree
can only be regarded as a great scientific
ment, even though it has been regarded
itable for some time now. It seems that
inevitably be followed by those of other

H. (East Malvern, Vic.) would like to see
adaptor described. He has in mind par-
the 17 watt ultralinear amplifier which
already constructed.
The whole subject of tape recording is
ich we could well revive and in a series
icles describe both tape adaptors and
e tape recorders. However, major inter-
the moment is in television. At the same
e must look after the beginners and near
ers. It is a long time since we described
ateur equipment, etc. Therefore, we can-
ake any definite promises on the tape re-
angle, but rest assured that the matter
forgotten. In the meantime, glad to know
u like the "Off the Record" feature.

A. (Elizabeth South, S.A.) writes concerning
cent Serviceman article on the subject of
ng TV picture tubes by isolating the heaters
a 1 to 1 transformer, in the event
heater-cathode short. He points out that
necessary to employ a transformer having
secondary to primary and secondary to
capacitance, otherwise there will be a
loss of the higher video frequencies.
Many thanks for your letter H.L.A. and
ll pass this on to the Serviceman for his
e comments. In the meantime, we must
that what you say is obviously quite
, and it will be interesting to see how
cal transformer manufacturers tackle the
n.

(Mascot, N.S.W.) asks if headphone
s can be used for recording. His idea
plug them into the speaker terminals of
att amplifier.
You do not say what type of recording
ve in mind. Probably it is tape recording
hatever the case, the headphone bobbins
t be of much assistance. A tape recording
is a fairly precise device with a very
gap. They have been made in home
ops but to make a really worthwhile head
s some workshop facilities and a fair
of skill. We published an article on
home-made tape heads in the November
ssue. A few copies of the article remain
files and you could obtain one through
query service. Note that tape recording
es the use of a high frequency bias oscillator
amplifier having higher gain than your
one.

C.J.H. (Port Augusta, S.A.) is puzzled by a set which continues to play faintly after the speaker is removed, and he wants to know if we can explain.

A. Without knowing the exact point at which the speaker was removed we cannot be certain of the reason C.J.H., but two possibilities occur to us. First, however, we must point out that it can be dangerous operating a set in this manner. If the speaker and output transformer are removed, the output valve will be deprived of plate voltage, causing the screen to overheat badly and probably damage the valve. If only speaker is removed, there will be no load on the output valve and very high voltages can be generated between the plate and other base pins, possibly resulting in flashover and damage to the valve socket. We suspect that it is the latter condition which you are producing, and the signal you can hear is probably due to lamination rattle in the output transformer. In the event that the speaker transformer is also removed, it seems likely that the output valve is now working as a crude triode, using the screen as a plate, and that some signal is appearing in the filter choke circuit, again producing sound by reason of lamination rattle.

N.S. (Wangaratta, Vic.) asks for the circuit on an "ultrasonic generator generating about 3,000 megacycles" and variable down to 1,000 cycles. He also asks about an amplifier to increase the power of the waves and a special "speaker" to convert the electrical vibrations to air vibrations.

A. One of the world's major 'suppliers of electronic instruments may be able to supply several instruments to cover the entire range you require—at a total cost of some thousands of pounds—but we certainly cannot help you with circuits or design information. However, we can supply circuits of an excellent audio generator covering up to about 0.5 Mc and an RF oscillator covering all the usual shortwave bands through the 2/- query service. Perhaps if you think over your requirements you will find that a relatively modest piece of equipment will serve. Propagation of "sound" waves above about 20 Kc/s is a specialised matter and if instruments are available commercially, it would only be on a limited scale.

T.S. (Footscray, Vic.) regrets that there is no radio club in Melbourne, though both Sydney and Adelaide have one.

A. We are not in a position to verify your statements, nor are we keen to become self-appointed sponsors of new radio clubs. Perhaps some other reader may have ideas on the subject and may wish to get in touch with our correspondent. His address: Mr. T. Sutherland, 128A Victoria St., Footscray, Vic.

D.O'K. (Newcastle, N.S.W.) sends in an idea for using "burned out" fluorescent tubes.

A. This seems to be quite a pastime, despite the moderate cost of new tubes. We have filed your letter for possible use in the "Reader Built It" columns.

T.K.L. (Willoughby, N.S.W.) has a number of appreciative comments to make regarding articles in our magazine. Of particular interest to T.K.L. are the series on electronic organs, featured some time ago, and the current Course for beginners. These, and particularly the latter, have proved informative and beneficial. T.K.L. also has a problem regarding the purchase of a clock movement as used in clock radios.

A. We note your appreciative comments with much pleasure and trust that you will continue to enjoy our publication. Clocks for clock radios have not been available lately in large quantities for the home builder mainly due to import restrictions. Limited quantities were made available at the time we described our cloxette but stocks were soon exhausted. Some have been available on odd occasions since, but we could not suggest any particular source at present.

C.T. (Northcote, Vic.) says that he has built many of our projects but is still looking for more ideas and more things to build.

A. You certainly have completed an imposing list of projects and your wife's resignation to the position is only to be understood. Regarding your suggestions, the bandspread idea you mention is well known to us, being one of many possible schemes. It is all right for a limited number of international bands but is less attractive for amateur use or where full coverage may be required with bandspread over any region of the spectrum. Your radiogram idea is quite practicable but the fashion these days is for separate amplifiers and tuners, at least for home-built gear.

C.D. (Caulfield, Vic.) is interested in the amateur bandspread tuner described in the January issue but would like to use a standard broadcast band tuning capacitor with a maximum capacity of 410 pF approx. instead of the special double spaced capacitor. The idea is to place small fixed capacitors in series with each section so that the effective maximum capacity is as required.

A. First of all the special double spaced capacitors are being made available by "Roblan" so that you should have no difficulty in buying one if you so desire. On the other hand your scheme is perfectly practical and has the advantage that it tends to spread frequencies towards the low frequency end of the band and give a better overall scale shape. As you will note from the February issue we have decided to increase the maximum capacity specified for the gang in order to make it easier to obtain coverage of the 7 to 11 Mc range. If you were to place a 100 pF capacitor in series with each gang section, the effective capacity would work out at about 80 pF which would be about right.

The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cut-outs in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

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● CF103	30	60	475	3
● CF105	15	80	325	3
● CF104	30	80	580	3
● F6-100	6	100	210	1
● F12-100	12	100	265	1
● CF106	12	100	200	3
● CF107	30	100	375	4
● CF196	20	125	255	4
● CF108	12	150	180	4
● CF109	20	150	225	4
CF396	4	200	50	3
● CF110	12	200	105	4
CF111	16	200	165	4
● CF112	10	250	80	4
CF113	5-20	250-5	80	4
● CF388	1	285	26	2
● F1-285	1	285	48	1
CF364	3	300	50	2
F1-325	1	325	27	1
CF115	0.017	2A	0.6	-

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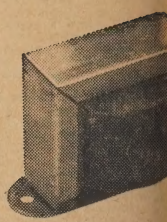
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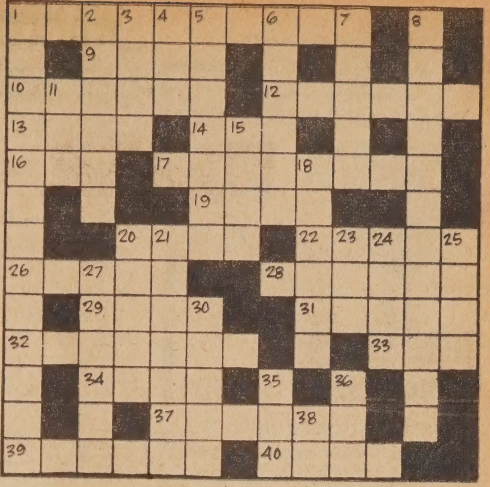


CROSS

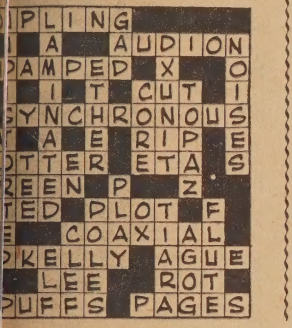
matts made from different fibres.
14. Fifth sign of the Zodiac.
16. Institution of Radio Engineers (abbrev.).
17. Back coupling.
19. On the side opposite to the wind.
20. Supplements.
22. Mathematics (abbrev.).
26. Insulated conductor.
28. Paralysing poison.
29. Act of running for a prize.
31. Leather strip for sharpening razors.
32. Making a noise with a horn.
33. A fruit enclosed with a hard shell.
34. Spun by spiders.
37. Greek mathematician.
39. To lie close and snug.
40. Indian soldier or constable.

DOWN

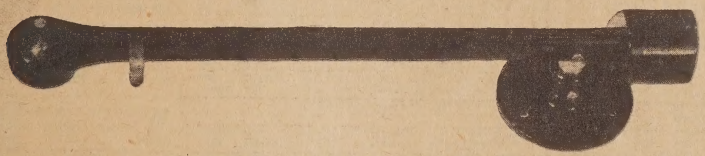
1. Conversion of AC into DC.
2. Form of Crystal oscillator.
3. He painted "The Laughing Cavalier."
4. First woman.
5. Centre of a colour pencil (2 words).
6. Eight-element valve.
7. Girl's name.
8. Army term describing penetration of enemy lines.
11. Implement for rowing.
15. Snake-like fishes.
18. To confuse.
20. Winged.
21. Unit of power level difference.
23. Employment of methods to do a thing well.
24. A small mountain lake.
25. A clan or race.
27. It happens to the skin with regulated sun-baking.
30. To follow.
35. A high mountain.
36. Bustle.
38. That is (abbrev.).

Solution and further crossword next month.

st month's solution



THE M.B.H. PICK-UP



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FOR SALE: Hi-Fi Enthusiasts. Vented enclosures complete with two high-quality speakers (a 12in and 6in) and crossover network. Brand new units but some slightly shop soiled at half price for £25 (while they last). **E.M.U. Electric, 36 Clovelly Rd., Randwick, FX7209.**

FOR SALE: Precision bench drill castings and print stocked by **Bolton, 72 King St., Sydney.** Catalogue 5/6 posted.

FOR SALE: Cossor 1039M Oscilloscope 3in. portable, suitable TV servicing, etc **WX4800, Melbourne.**

FOR SALE: 1KV pow. sup., 5in Cossor CRO Q. 5ER Valves 6J6, 6AG5, 809s, 807, 1625, 5BP1 cheap. Pan adaptor 240v oper., 50w mod. and pow. sup., also other valves and parts. **170 Dunning Ave., Rosebery.**

FOR SALE: Pyrox Magictape tape recorder twin track 3¾in per sec. with built-in Playmaster tuner No. 3. Complete with 1,200 reel of tape, spare reel and microphone. This machine is 12 mths. old, has had little use and is in new condition. Cost £140 new, without tuner £100. **Phone LM8717, Sydney.**

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FOR SALE: Quantity of transmitting equipment sig. generators, record cutting equipment, also valves, speakers, tape recorder, etc., £162 or best offer. **E. M. Hayward, 25 Vale St., Katoomba.**

FOR SALE: Back Nos. R. and H. for sale. April, 1939, to Oct., 1956, 2/ posted. Nov., 1956, to current copies 3/ posted, quote on large lots, also will buy spare R. and H. you have. If out of stock, I will get it for you. **A. J. Cox, 13 Glover St., Belmont, N.S.W.**

FOR SALE: A Radiotron amateurs communications receiver, less tubes and speaker £12. Pilot T.R.F. ham set, less power pack and tubes £6. Plessey 3-speed changer Ronette cartridge £10. Vibrator 6v complete £3. **W. Heath, Flat 3, 2 Musgrave St., Mosman.**

FOR SALE: Antiference 317 TV antenna, as new, £12. **5 Buick Rd., Deewhy West.**

SELL: Mullard 5-10 Hi-fi amplifier (ultra Linear version) professionally wired and assembled, hardly used £19/10/-. Complementary R and H tuner (6AE8 and ¾ 6N8) £4/10. RF 26 converter 50-65 Mcs unused £7/10/. Disposals 20-watt modulation transformer £1/10/. **R. Jones, 25 Panoramic Road, N. Baldwyn, Vic.**

SELL: U-L KT66 Amplifier, power pack (thermal tube protection) £45; Baxandall pre-amp. (W.W., May, 57) £10; Collaro Transcription Deck £15; Blackwood enclosure with 9in Baker speaker £15. **Melbourne, MF5905.**

SELL: R. and H., Aug., 56, to July, 57, incl. 22/ posted. **86 Lang St., Padstow. UU7342.**

SELL: S.T.C. com. rec. 2 RF21F stages £30. Want a good pr. type "C" Baldwin headphones. **3 Macarthur St., Fairfield, N.S.W.**

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SELL: AR8 communications receiver AC, phones or speaker. £18. **Bell Illawarra St., Carlton, N.S.W. LJ3115.**

SELL: New craftsman-built Rola 9 c polished vented enclosure complete w Hi-Fi 12 U.X. loudspeaker £50 **FM55 bourne.**

SELL: "Nova" type G tape deck gram drive, with heads and osc. coil As n **Sharrock, Taggerty, Vic.**

SELL: A.R.8 Receiver and Power Sup good order but needs tune-up. Best **£15. Radio 3CV Maryborough, Vic.**

SELL: Tape Recorder English Vortexi able Prof. Model 2B. Speed 7½in. heads, double track, etc., 3 mths. old. bargain, £165. **Ring BA3772, Sydney.**

SELL: Hi-Fi radiogram chass. with s.w LP equal'n, bass and treb., 30-20 £49/10/. **A. J. Bennie, 53 Outlook Driv mont, Vic.**

SELL OR EXCHANGE: Radio parts experimenter. **Phone LU2017, Sydn**

SELL: Every back issue R. TV and H at all times 2/ per copy, two or mo 1/6 ea. Jan., 1957, to date 3/ ea. All clude postage. **T. Weir, 56 O'Connor St field, Sydney, N.S.W.** Call and select copies from large stocks for only 1/ e for quantity. Inquiries welcome. Ring anytime.

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